OCTOBER 10, 1955

STEEL
The Metalworking Weekly

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542 metals

STEEL's Selector (page 146) will help you pick the right metal for the job

Metal Show Issue

- Choose the Right Arc Welding Electrode . . . page 138
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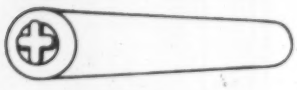
THIS IS AETNA-STANDARD

SEAMLESS TUBE MILLS

Aetna continues to conceive many new ideas for the production of seamless tubing. This continued progress, plus reputation and experience, helps Aetna-Standard to continue as world's leading designer and builder of Seamless Tube Mills.

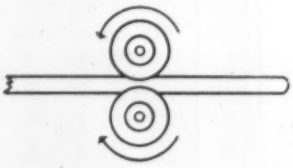


ROLLS

Aetna specializes in manufacture of small and medium-sized iron-base rolls. Aetna is pioneering in the use of Nodular Iron for rolls and castings under trade name of Magaloy.

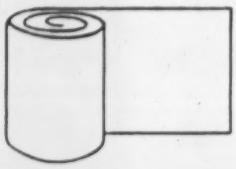
FLAT-ROLLED FINISHING EQUIPMENT

This is one of Aetna's six major product lines. Flat-rolled embraces such equipment as: Shearing and Classifying; Scrubbing and Drying; Recoiling; Slitting and Side Trimming; Roller Levellers (two-high and four-high); Reels of all kinds; and many other products.



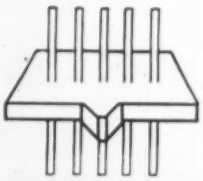
CONTINUOUS BUTT WELD PIPE MILLS

Over the years, new ideas and engineering accomplishments have strengthened Aetna's position as the only builder in America of Continuous Butt Weld Pipe Mills. In recent months, Aetna Pipe Mill equipment has been installed in America, in Canada, in Germany, in England, in Japan and in Argentina.



CONTINUOUS COATING

This year Aetna will have completed the building of 25 continuous galvanizing lines, in addition to several terne and electrolytic tinning lines. Aetna has worked closely with industry in this development and is considered the pioneer in continuous coating equipment.



COLD DRAWING

The world over, Aetna-Standard is recognized as the leading authority and builder of cold draw equipment for tubes and bars. This year marked introduction of several innovations by Aetna, such as the air gripper carriage and hook.

THE AETNA-STANDARD ENGINEERING COMPANY • PITTSBURGH, PA.

Aetna-Standard

PLANTS IN WARREN, OHIO • ELLWOOD CITY, PENNSYLVANIA

GOOD EQUIPMENT BRINGS DOWN PRODUCTION COSTS

SUBSIDIARY and ASSOCIATED COMPANIES

Head Wrightson Machine Company, Ltd., Middlesbrough, England—Great Britain, Finland, Sweden, Norway, Denmark, Union of South Africa, Northern and Southern Rhodesia.
Aetna-Standard Engineering Company, Ltd., Toronto, Ontario, Canada.
M. Castellvi, Inc., New York, N. Y. — Mexico, Central and South America.
Societe de Constructions de Montbard, Paris, France — France, Belgium, Holland, Luxembourg, Switzerland.
Demag Aktiengesellschaft, Duisburg, Germany — Germany, Austria, Yugoslavia, Greece, Turkey, Egypt.
Compagnia Italiana Forme Acciaio, Milano, Italy — Italy.
Aetna-Japan Company, Ltd., Tokyo, Japan — Japan.
Hale & Kuligren, Inc., Akron, Ohio — Representative for the Rubber Industry.
Standard Engineering Company, Ellwood City, Pa.
Trans-World Traders, Pittsburgh, Pa.

Designers and Builders to the Ferrous, Non-Ferrous, Leather, Rubber, and Plastic Industries

XII

This is the twelfth of a series of advertisements dealing with basic facts about alloy steels. Though much of the information is elementary, we believe it will be of interest to many in this field, including men of broad experience who may find it useful to review fundamentals from time to time.

Vanadium Alloy Steels and Their Uses

Though the beneficial effects of vanadium in alloy steels have been known for many years, the ore was at one time a comparative rarity. Vanadium is still rather expensive because of the care required in processing the ore; however, there are now ample supplies for present-day applications.

Vanadium is a highly valuable alloying agent. It is an extremely powerful deoxidizer, though seldom used primarily for that purpose. Vanadium also tends to form stable carbides in steel—carbides that do not go readily into solution when heated above the critical temperature for quenching. The grain-growth-inhibiting effect of vanadium promotes a fine-grained structure over a fairly broad quenching range, thus imparting strength and toughness to the heat-treated steel. Moreover, the carbides are not prone to agglomerate during the tempering operation.

Vanadium is used in constructional steels, not only to refine the grain, but to improve the mechanical-property balance. Generally speaking, the amount of vanadium in constructional steels ranges from approximately 0.03 to 0.25 pct, though larger quantities are required in tool steels and special analyses.

A list of products containing vanadium would include certain types of spring steels, plates, gears, high-temperature steels; forged axles, shafts, and turbine rotors; and other items requiring impact- and fatigue-resistance.

You are invited to consult with our staff whenever you need information about vanadium steels. Bethlehem metallurgists will gladly advise you regarding analyses, heat-treating, machining, and anticipated results. Please remember that the services of these technicians are yours for the asking, and that no obligation is implied.

And may we point out, too, that Bethlehem makes all AISI standard alloy steels, as well as special-analysis steels and the full range of carbon grades. Call upon us for your alloy steel requirements; now and always, we will endeavor to meet your needs promptly.

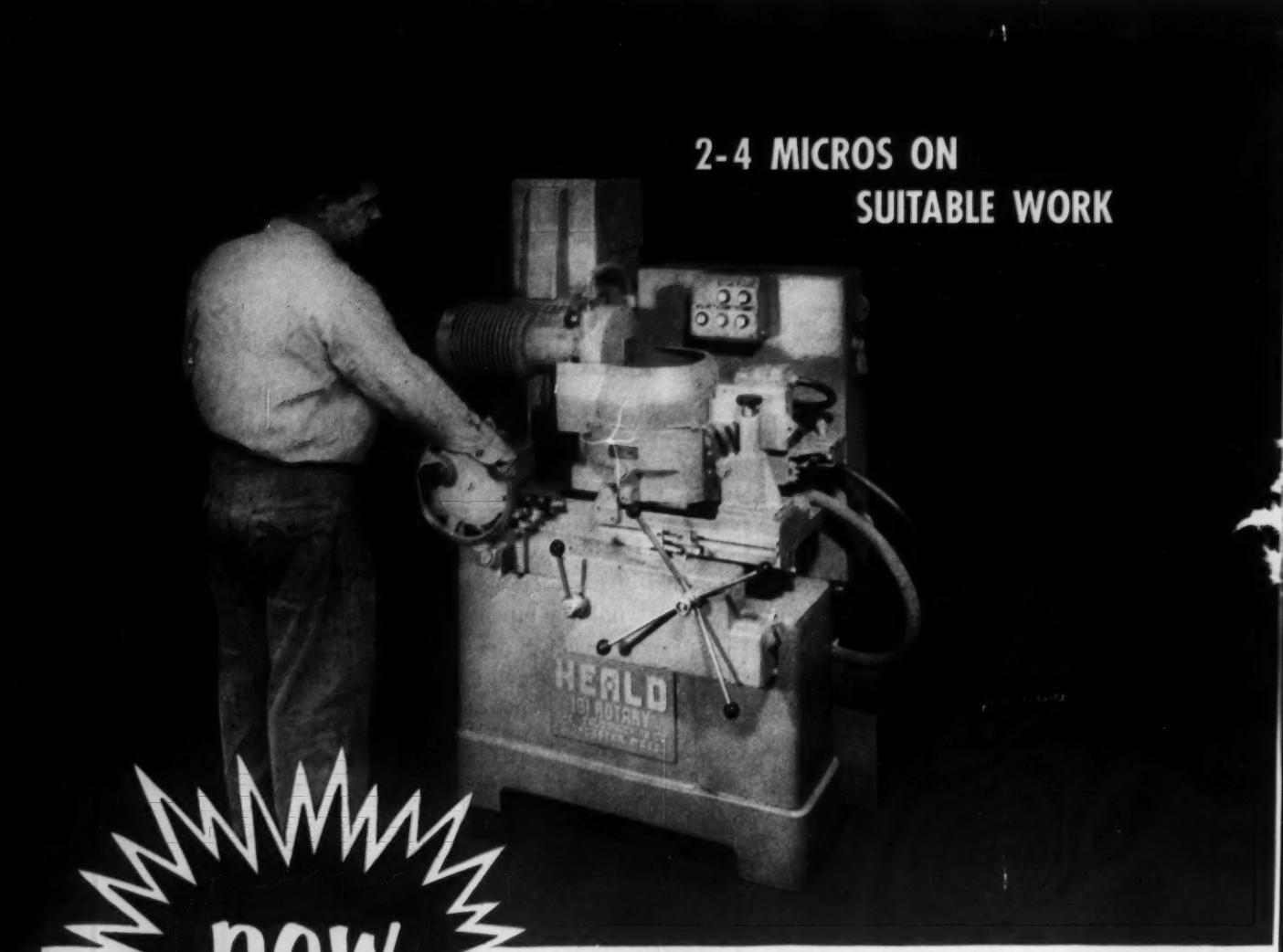
If you would like to have a reprint of this advertisement, or of the entire series from I through XII, please write to us, addressing your request to Publications Dept., Bethlehem Steel Company, Bethlehem, Pa.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL



new

HEALD MODEL 161 ROTARY

provides new precision and economy for surface grinding SMALL PARTS

- Manual or Power Reciprocation
- Dry or Wet grinding
- Simple Mechanical Operation
- Grinds Flat, Convex or Concave
- Extremely Low Microinch Finish
- 6" Magnetic Chuck
- Extra Rigidity and Weight
- More Power to Wheelhead
- Column-Type Construction
- Moderate Cost

This completely new column-type Rotary is ideally suited to the general run of small surface grinding work — permitting greater accuracy and better finish than heretofore readily obtainable from equipment of this small size and moderate cost. On display at the Machine Tool Show, the Model 161 consistently turned out hardened steel gear cutters with concave faces ground to a 2-4 microinch finish.

Choice of manual or automatic power table reciprocation permits maximum operating efficiency on individual parts, small lots or long run jobs. Other outstanding features of this compact, versatile surface grinding machine are listed at the left. The bulletin mentioned below will give you the complete story.

Heald also offers two other sizes of high-precision, column-type Rotaries — the Model 261 for medium size work and the big, heavy-duty Model 361 for large work. Information will be gladly sent on request.

For profitable precision finishing on any type of work, IT PAYS TO COME TO HEALD!

Write today for your copy of Bulletin 2-161-S.

THE HEALD MACHINE COMPANY

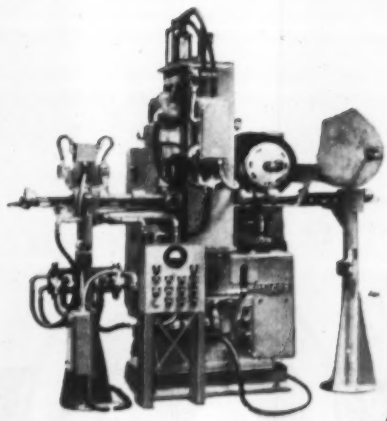
Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

HEALD

BRUSHAMATION BY OSBORN



AUTOMATED BRUSHAMATIC®...One of Osborn's integrated production line automatic power brushing machines.

The parts shown above are typical of the work you can now handle with Osborn's line-production power brushing method... ***BRUSHAMATION.***

COMPLETELY INTEGRATED...Osborn's Automated Brushamatic® Equipment fits right into your production line.

ELIMINATES BOTTLENECKS. It is now possible to remove burrs, blend surface junctures, remove weld scale, clean parts on a continuous line-production basis.

AUTOMATES FINISHING OPERATIONS . . . takes parts right from your production lines, feeds them to rotating power brushes, delivers them precision-finished to micro-tolerances where necessary

. . . all without manual handling.

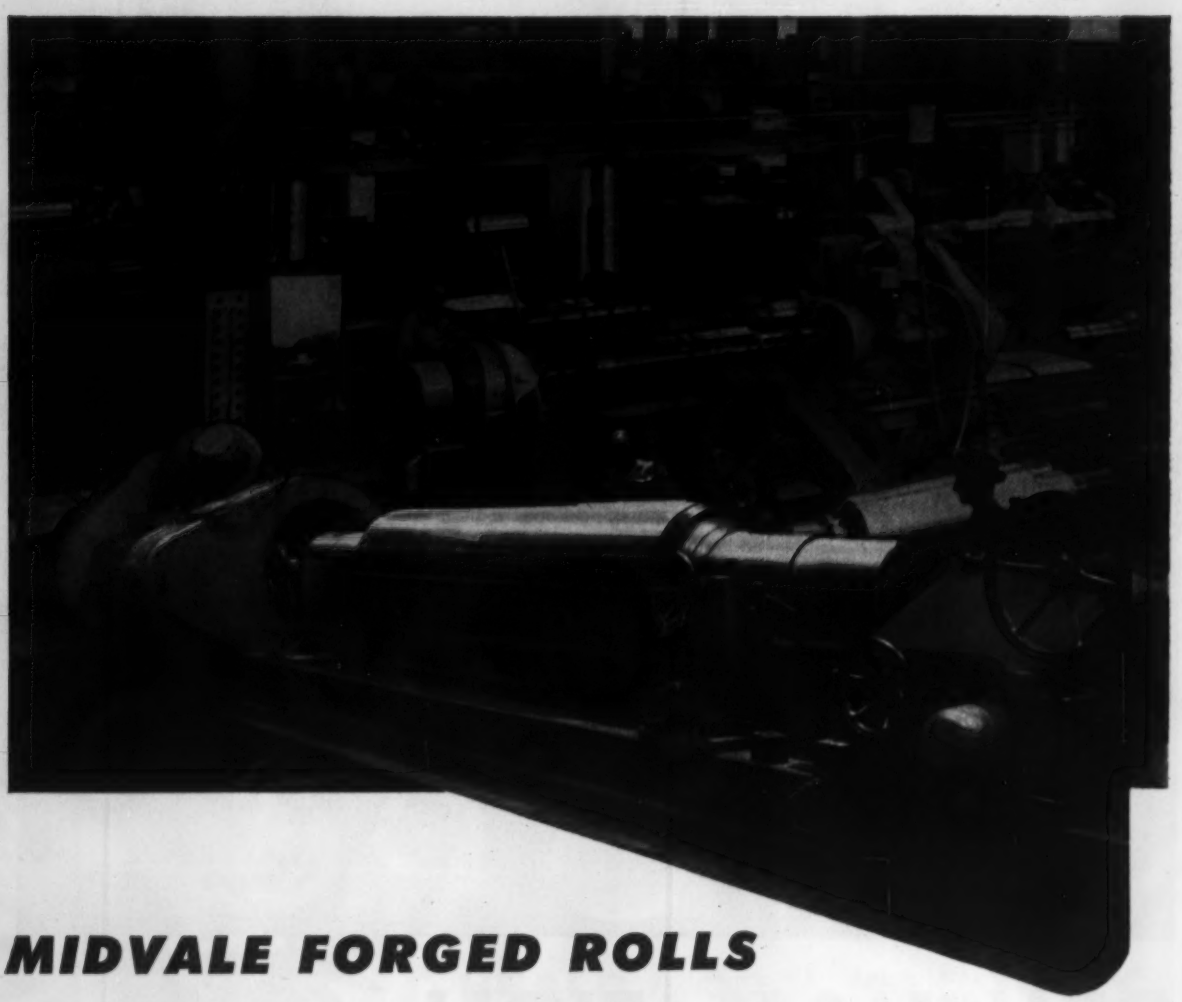
Qualified engineers will show how you can benefit with automated brushing at the Osborn Booth 718, The Metal Show, Philadelphia, Oct. 17-21. If you can't make the show, write us for complete information. *The Osborn Manufacturing Company, Dept. G-37, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

Osborn Brushes

© 1955 The Osborn Manufacturing Company

OSBORN

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES



MIDVALE FORGED ROLLS

TOUGH ROLLS TO BEAT AT THE FINISH

From the furnace to finished grind Midvale Forged Steel Rolls are made with greater durability to provide a finer finish for longer runs.

Half a century of roll making experience skillfully shapes rolls under the right size press for the particular roll . . . produces the maximum in grain refinement. Careful heat treatment gives them the required surface hardness, up to 105 Shore, and endurance qualities underneath. A series of inspections, including sonic testing, approve it for service.

Do you need high quality, longer lasting forged rolls in your mill? Whether they are for strip or sheet mills . . . precision rolling of copper, aluminum or other metals, let Midvale roll specialists show you why you can be sure of a good finish when you start with Midvale Forged Steel Rolls.

THE MIDVALE COMPANY-Nicetown, Philadelphia 40, Pa.

Offices: New York, Chicago, Pittsburgh, Washington, Cleveland, San Francisco

MIDVALE

FORGINGS, ROLLS, RINGS, FLANGES, CORROSION AND HEAT RESISTING CASTINGS

STEEL
The Metalworking Weekly

OCTOBER 10, 1955
Vol. 137 No. 15

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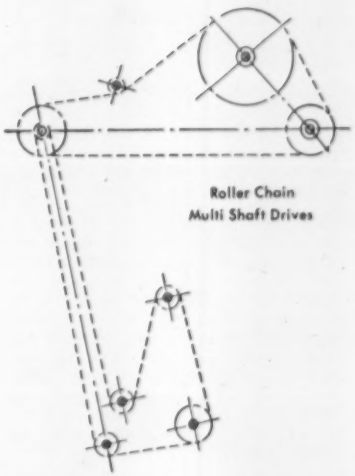
ACME CHAIN

Roller Chain
ENGINEERING SERVICE
'Yours'
FOR THE ASKING



Acme engineers will gladly work shoulder to shoulder with your designers to plan the details of sprocket, ratio, chain impact, tension, drive speed and other factors necessary to obtain the maximum efficiency and economy on your project.

WRITE OR PHONE JEfferson 2-9458

NEW CATALOG
76 pages of useful chain data. Write Dept. 10V for your free copy.

Acme Chain Corporation

LABOR RELATIONS ?

O. W. Thuerlemann

PRESIDENT • CINCINNATI GEAR CO.

That phrase "Labor Relations" has always bothered me. Personally I think it's the most misleading phrase in our language. Labor, to me, means hard, back-breaking toil, perhaps like the galley slaves of old — now that was really labor! We at Cincinnati Gear prefer a phrase like "Craftsmen-Management Relations."

After all, the men who work in our plant *are* craftsmen—skilled craftsmen of the highest order. We are managing the business—our skilled craftsmen are turning out the perfect gears that are the lifeblood of our business.

These men are important—we strive at all times to give them the finest machinery and the most pleasant working conditions possible. Craftsmen who have been with us five years or more are covered by a pension plan, with retirement benefits up to 30% of their regular monthly pay; our suburban location means a cleaner and more beautiful plant; color experts decided what color paints would be most conducive to a pleasant atmosphere inside our plant.

Our efforts have not been in vain—for over thirty years, when virtually every company had so-called "Labor" problems, production and pleasant relations at Cincinnati Gear continued as in the past.

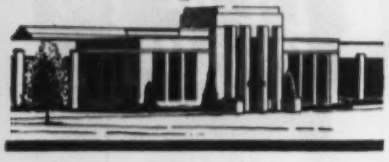
No, we don't employ laborers at Cincinnati Gear—they are, and always will be, "Skilled Craftsmen!"

THE CINCINNATI GEAR CO.

CINCINNATI 27, OHIO

"Gears — Good Gears Only"

CINTI



behind the scenes

Orchids Department

By the way, a fortnight or so ago we reported STEEL's winning ways in competition sponsored by the Direct Mail Advertising Association. (A first award for the second straight year in Class I, direct mail employed to create more effective personal sales contacts.) What we forgot to mention was that STEEL was the only publication to rate this award—both this year and last. In the photo below, Sal Marino, STEEL's circulation and promotion director, is getting this year's award bestowed upon him. He's on the right. Arthur W. Theiss, past president of DMAA, is the gentleman on the left.

That old business brings to mind some new business in the awards department. The Art Directors Club of Cleveland will hold its seventh annual exhibition this year at the Cleveland Museum of Art, Oct. 12 to Nov. 13. This news ordinarily wouldn't move us to turn handsprings. This year, however, the exhibition committee of the organization selected six covers (four STEEL, one *Machine Design*, one *Automation*) to hang at the show.

It ain't every day that you see the cover of a business magazine hanging from walls that hold the works of Rubens, Leonardo da Vinci, Velasquez and Rembrandt. The winning covers: Nov. 29—picture of slightly sprung oil derrick; Nov. 22—a large black stove; Dec. 27—a set of export tags. Artist Tom Bryan dreamed up and executed these splendid covers. The fourth one, Dec. 20, features two electric plugs. It's the work of artist George (Tiger) Farnsworth, who also created the *Machine Design* and *Automation* covers.

Tricky Insert

Unless you are a student of metals, you have no idea of the number of alloys in commercial use. One of management's most sensitive jobs is the selection, specification and purchase of the right metal for the job.

STEEL, therefore, includes a Metal Selector with this issue: A ten-page insert filled with tables of information on newest alloys and old standards.

How so much information could be packed into such a limited space is one of the wonders of the publishing business. After Allen G. Gray, technical editor, assembled his monumental findings, Art Director Bill Kellogg got the job of figuring out how it might be printed. Kellogg, Dr. Gray and typographer Charley Van Dame were practically standing on their heads before the insert went to press.

Metallic Marvels

STEEL's Metal Selector, of course, is published to coincide with the coming 37th National Metal Congress and Exposition, beginning Oct. 17 in Philadelphia. Naturally, only a small percentage of the men responsible for making better products faster and cheaper will be able to attend the show. STEEL's big Metal Show issue herewith presents some ideas that metalworking men can translate into bigger profits. For those attending the show, there is a complete technical program and a listing of exhibitors.

Shrdlu

(Metalworking Outlook—Page 93)

Simplified Automatic Welding Speeds Work and Lowers Production Costs on Air Preheaters

Greater savings in production costs are being realized more and more by metal working industries that are quick to see the many advantages of automatic welding.

No more complicated installations, no more troublesome electronic and electrical controls. You can depend upon Hobart's "POWROMATIC" constant voltage and new simplified controls to give you perfect welds automatically and continuously—thus reducing labor, time and material cost.

This is but one of many installations of Hobart Automatic Welding Equipment that is paying off for the user. If you have a welding operation—investigate now, and see how you can take advantage of lower production costs.

There's no cost or obligation—why not see for yourself what can be done to cut your own costs.

Write — wire — or 'phone

HOBART BROTHERS COMPANY
Box ST-105, Troy, Ohio, Phone 21223

When your product is a fuel saver that cuts your customer's operating costs

YOU'RE COST CONSCIOUS

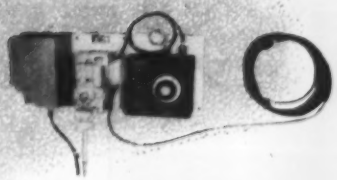
That's why The Preheater Corp., Wellsville, N. Y., one of the largest manufacturers of Air Preheaters, installed the new

HOBART

Automatic Constant Voltage Welders with "SIMPLIFIED" welding head and controls.

SEE US
Space 1020
Center Bldg.
Philadelphia
AWS NATIONAL FALL MEETING

Hobart's "simplified" control and "Powromatic" constant voltage power source improve automatic welding results—each unit can be used with existing setups, or teamed for superior results.



Automatic Welding Head and Simplified Controls

HOBART BROTHERS CO., Box ST-105, Troy, Ohio, Ph. 21223

Without obligation, please send me complete information on items checked below.

- ☐ Complete information on Hobart CV POWROMATIC and Heads for Automatic Welding.
- ☐ Tell me how we can simplify Automatic Welding with our present Heads by using Hobart POWROMATIC.
- ☐ Send latest HOBART Simplified Arc Welder Catalog.

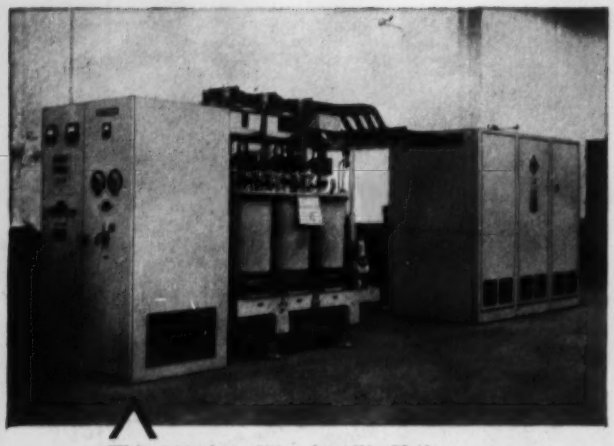
NAME _____ POSITION _____

FIRM _____

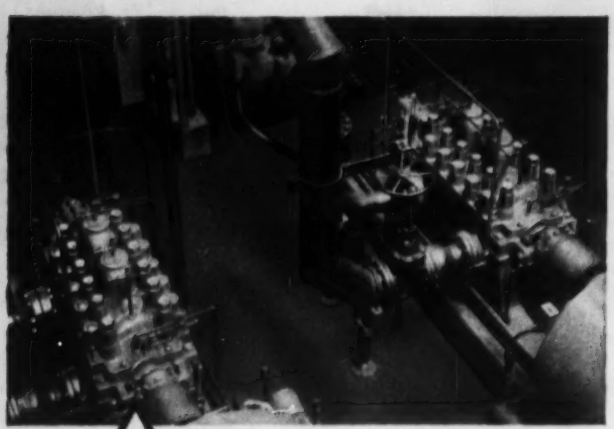
ADDRESS _____

Helping Youngstown Top Steel Year After

ALLIS-CHALMERS Steel Mill EQUIPMENT



This 1000-kw, 250-volt Allis-Chalmers mercury arc rectifier furnishes direct current to cold mill auxiliaries. An additional low-first-cost, high efficiency unit of this type and capacity is being installed in the tin mill.



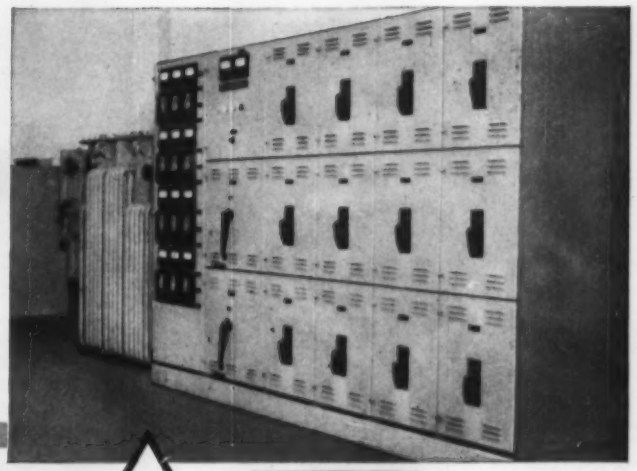
Two 6 by 4 five-stage Allis-Chalmers descaling pumps rated 1000 gpm, 1140 psi. Allis-Chalmers has also furnished fire pumps, motors and controls for other applications at the Indiana Harbor mill.

Equipment Installed in 1940 Still Going Strong as new Equipment is Added to Keep Pace with Today's Production and Quality Requirements

A-C ALLIS-CHALMERS

ALLIS-

Obtain Production Year



Allis-Chalmers 1000-kva, 440-volt substation serves the cold mill at Youngstown's Indiana Harbor Works. Unit has nonflammable *Chlorextol* liquid-filled transformer. Additional substations of larger capacity are now being furnished for expansion at this plant.

These two Allis-Chalmers 6000-kw, 600-volt motor-generator sets supporting the 54-inch hot strip mill have been operating at rated capacity and above for 15 years — with minimum maintenance.

SWITCHGEAR, transformer, substation, and rectifier equipment was recently added to the growing list of Allis-Chalmers installations at The Youngstown Sheet and Tube Company's Indiana Harbor Works. These Allis-Chalmers units were specified for the new cold mill that is part of the major expansion program at the Indiana Harbor plant.

For many years, Allis-Chalmers equipment has served Youngstown well. Motor-generator sets, motors, pumps, *Texrope* drives, transformers, switchgear—all have been supplied over the years to help keep production at The Youngstown Sheet and Tube Company plants modern, flexible and economical.

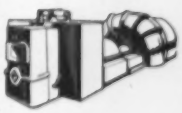
You too can take advantage of the wide range of Allis-Chalmers products and superior service . . . backed by experience gained serving the steel industry since the days of the famed Corliss engine drives. For help in planning new facilities or modernizing present plants, contact the A-C office in your district, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4836

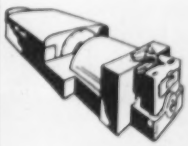
CHALMERS

Other Allis-Chalmers Equipment for the Steel Industry

Wide Range of Motors for main mill and auxiliary drives — ac or dc — from 1 hp to 10,000 hp — and supporting rectifiers or m-g sets.

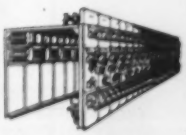
Blast Furnace Blowers are an important part of the complete A-C line of single and multi-stage centrifugal blowers, axial and rotary compressors, and vacuum pumps for the steel industry.





Power Generation Equipment includes steam turbine-generator units 2000 kw and larger for fluctuating steel mill loads. Also condensers, pumps and auxiliary drive motors.

Steel Mill Control offered by Allis-Chalmers includes constant potential and variable voltage systems, magnetic amplifier, electronic and mechanical regulators, and liquid rheostats.



Chlorextol and *Texrope* are Allis-Chalmers trademarks.

THE DIES ARE YOURS FREE!

Yes, we do hundreds of stamping jobs without making special tools—and there's a good reason for this. In stamping out laminated shims for over forty years, we've developed much special equipment and tooling unknown in the average stampings house... including an arsenal of blanking dies and punches...and we've acquired unusual production techniques and skills. This equipment and these special skills are at your service without charge.

ROCK-BOTTOM PRICES . . . BY THREE METHODS!

These three separate production techniques are judiciously applied to save you money on your stamping needs!

MACHINE CUT METHOD. Regardless of quantity, we have the method that fits your needs best! For half-a-dozen or a few hundred stampings, our *Machine Cut Method* produces the stampings at amazingly low cost.

SHORT RUN METHOD. As quantities increase, we shift to the *Short Run Method*, with stock tooling and temporary dies—such as the surprisingly low-priced Hecht-type die.

PRODUCTION METHOD. Or we shift to our *Production Method* using high speed self-feeding presses.

For full information, send for our free 12-page booklet "Service In Stampings." And next time you need stampings, why not let us bid—and discover the savings we offer you!

LAMINATED SHIM COMPANY, INC.

STAMPINGS DIVISION

"ONE PIECE OR ONE MILLION"

3410 UNION STREET • GLENBROOK, CONNECTICUT

LETTERS
TO THE EDITORS

Magnesium Survey Well Done

The survey, "Magnesium: A Metal That's Going Places," (Sept. 5, page 46), was well done. It paints a sound but not rosy picture, placing our future in the hands of the people who must get out and do something about it. We would appreciate 50 tear sheets for distribution purposes.

Jerry Singleton
Executive Secretary
Magnesium Association
New York

Article Supports Opinion

Your article, "IRS Tightens Up on Leasing" (Sept. 19, page 71), was interesting. I am forming a corporation for leasing equipment of my own, and it bears out facts and opinions I have found difficult to explain to prospective lessees. I would appreciate ten copies.

Don D. Sheriff
Manufacturers' Representative
125 W. Third St.
Tulsa, Okla.

Analysis Saved Millions

We note with interest your article, "Value Analysis: Equal or Better Performance at Lower Costs" (Sept. 19, page 101), No. eight in your Program for Management series.

The material and parts analysis section of this division has been engaged in this same work for four years, with savings that averaged over a million dollars a year for the division. Hence, you will appreciate our enthusiasm. May we have three copies? We plan to distribute them to our plants in this area.

G. E. Chester
Supervisor
Material & Parts Analysis Section
Division Controller's Office
General Mfg. Division
Ford Motor Co.

Quicker Carbide Casting

Where can we obtain more information on the resistance furnace method described in the Technical Outlook column of Sept. 12 (page 97)? It was in the paragraph, "Quicker Carbides."

Carl L. Roethke
Engineering Department
Severance Tool Industries Inc.
Saginaw, Mich.

• *Write Ralph Abos, president, Component Parts Co., Whittier, Calif.*

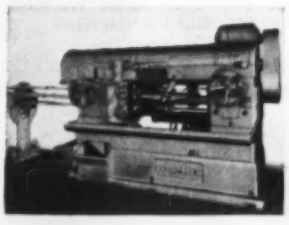
Hassle, Not Hassel

We invented the word, "hassle." You won't find it in your dictionary, but it so adequately describes what goes on in modern industrial life that it will undoubtedly become an established word.

(Please turn to page 12)

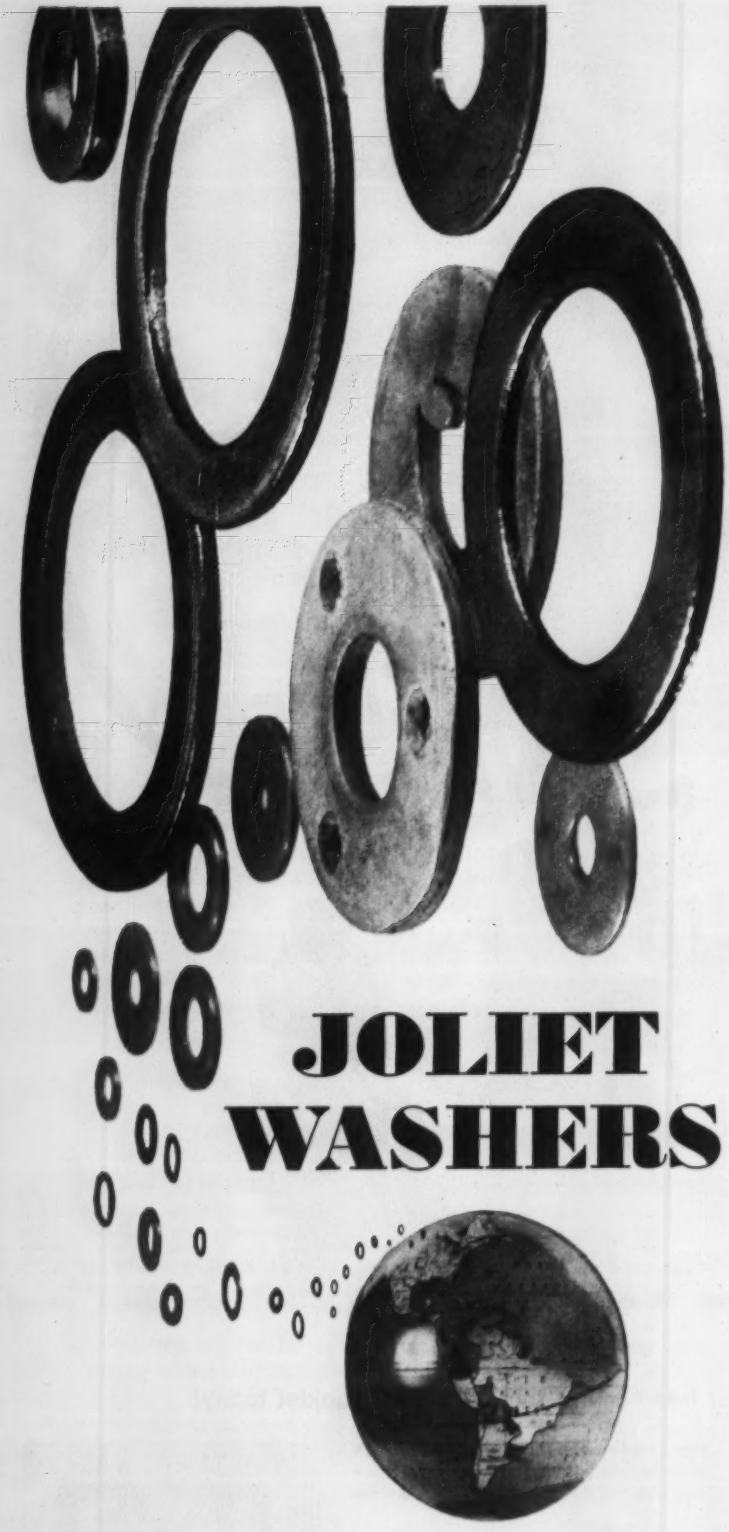
If you haven't read this important booklet, your production line may be operating at less than peak efficiency. Your operations may be beating competition with HSS today, but you will likely need carbide tooling to be the leader tomorrow.

Write for your free copy of this important booklet today!



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.



WORLD'S FOREMOST PRODUCERS
OF ALL KINDS OF FLAT WASHERS
JOLIET WROUGHT WASHER CO., JOLIET, ILLINOIS

LETTERS

(Concluded from page 10)

It is coined from "harangue" (ranting speech) and "tussle" (rough controversy).

It is an apt word so we, as purists, object to the misspellings and misuses of the word that have come to our attention. "Hastel," "hassel" or "hasel" are wrong. Please inform your readers.

Jack Usher Mowll & George B. Franz
Technical Publications Group
Manufacturing Division
Glenn L. Martin Co.
Baltimore

Firm Wants to Reprint

We would like to use the article, "Vapor Degreasing Earns Its Keep," (Sept. 13, 1954, page 124) in our house organ, *Modern Metal Finishing*. This publication is mailed to about 17,000 personnel in the metalworking industry. May we have permission to reprint?

Richard W. Lounsbury
Advertising Department
E. I. Du Pont de Nemours & Co.
Wilmington, Del.

• *Permission granted.*

Adverse Reaction to Zinc?

I have noted with interest the article, "A Lifetime of Corrosion" (Sept. 12, page 118).

Weathering tests at the three test sites show that zinc (prime western) had the greatest weight loss. This is not unexpected since zinc, particularly as a coating finish, usually offers the greatest sacrificial protection.

Some might have an unfavorable reaction to zinc coatings of the Hot Dip Galvanizers Association process after seeing the chart. I would appreciate your opinion as to whether zinc is the best rust resistant coating.

Stuart J. Swensson
Secretary-Treasurer
American Hot Dip Galvanizers Association Inc.
Pittsburgh

• *We suggest you write directly to the person who reported the zinc results: E. A. Anderson, New Jersey Zinc Co., Palmerton, Pa.*

Pattern Maker Located

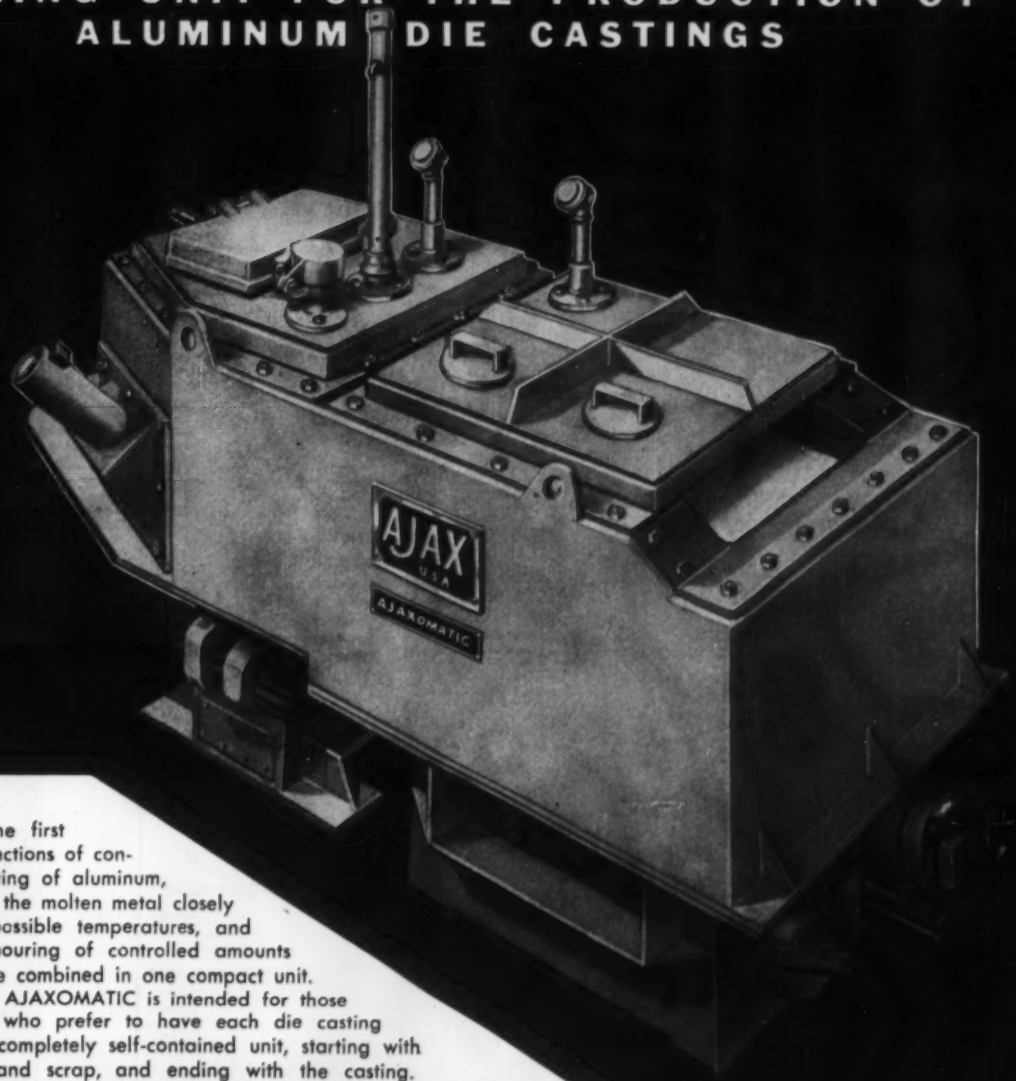
What is the address of the Elwood Pattern Works mentioned in the article, "Vacuum Brightens Metal Picture" (Sept. 19, page 126)? This article also told about a product called Narliner, made by NRC. What is the name and address of NRC?

J. D. Keller
Industrial Engineer
Radio & Television Division
Sylvania Electric Products Inc.
Williamsport, Pa.

• *The Elwood Pattern Works is at 125 N. East St., Indianapolis 4, Ind. NRC is the National Research Corp., 160 Charlemont St., Newland Heights 61, Mass.*

The New DUPLEX
AJAXOMATIC

AN INTEGRATED MELTING AND AUTOMATIC POURING UNIT FOR THE PRODUCTION OF ALUMINUM DIE CASTINGS



Here for the first time the functions of continuous melting of aluminum, maintaining the molten metal closely at lowest possible temperatures, and automatic pouring of controlled amounts of metal are combined in one compact unit. The Duplex AJAXOMATIC is intended for those die casters who prefer to have each die casting machine a completely self-contained unit, starting with pig metal and scrap, and ending with the casting. This unit represents the ultimate in integration and automation to match today's trend towards larger die castings and higher production rates per machine and per manhour.

See It On Display at the Metal Show, BOOTH 1619

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AJAX TAMA-WYATT

INDUCTION MELTING FURNACE

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AJAX ELECTRIC CO., The Ajax Hultgren Electric Salt Bath Furnace
AJAX ELECTRIC FURNACE CORP., Ajax Wyatt Induction Furnaces for Melting

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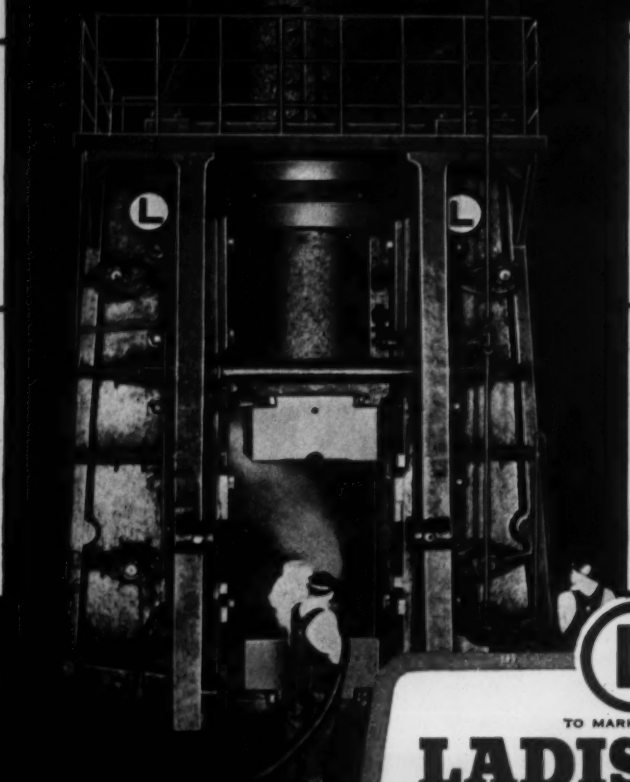
OFFERS GREATER LATITUDE IN THE DESIGN OF LARGE COMPLICATED PARTS



WORLD'S LARGEST FORGING HAMMER

80,000 MKG counterblow forging hammer, the most powerful known in the world, is estimated to be equivalent to 100,000 pound one way steam drop hammer if such were available.

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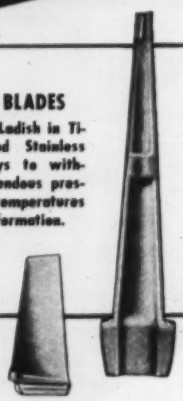
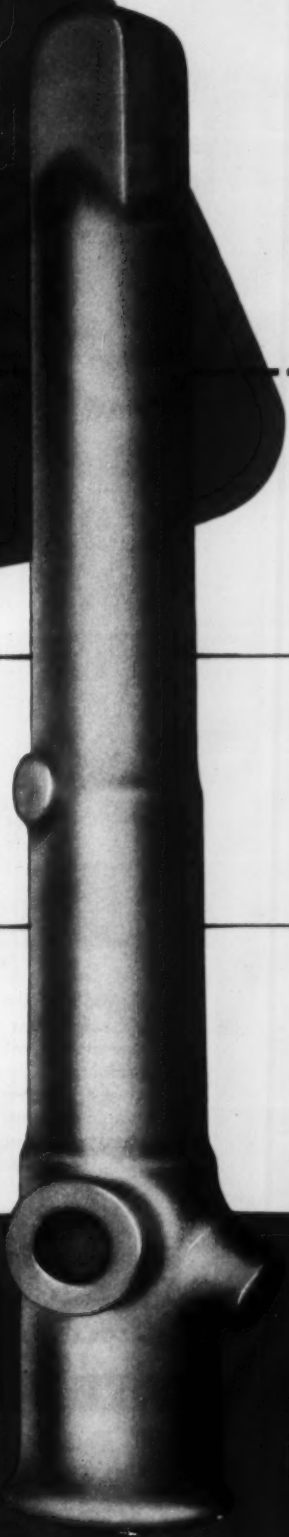
Forged by Ladish in Titanium and Stainless Steel Alloys to withstand tremendous pressures and temperatures without deformation.



LANDING GEAR

Outstanding example of Ladish heavy drop forgings: 8500 pounds, 132 inches in length. Drop Forging saved material and machining cost for 5000 pounds of Chromium-Nickel-Molybdenum alloy steel.



TO MARK PROGRESS

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CUDAHY, (Milwaukee Suburb) WISCONSIN

Controlled Quality

DROP FORGINGS UP TO 10,000 POUNDS,
WELDED AND SEAMLESS ROLLED RINGS UP TO 60,000 POUNDS

REGARDLESS OF SIZE, CONTOUR OR MATERIAL...YOU CAN DEPEND ON LADISH

Ladish pioneering in tremendous closed-impression-die forgings offers engineers new freedom in extending the inherent advantages of the drop forging process to intricately shaped parts weighing as much as *10,000 pounds*. Drop Forging close-to-finish dimensions materially reduce metal and machining costs . . . while improvement in dynamic strength and toughness makes possible substantial reductions in dead weight . . . and higher factors of safety.

A discussion of your products with a Ladish forging engineer will provide specific data on the ultimate economy and improvement in design you can impart to your own products by specifying forgings . . . Ladish Controlled Quality forgings.

WITH CLOSED-IMPRESSION-DIE DROP FORGINGS WEIGHING UP TO 10,000 LBS.

TITANIUM PROPELLER BLADE

Again Ladish pioneers with the largest known Titanium forging produced in closed-impression dies. 40% saving in weight realized by forging this 100-inch blade in "wonder metal" Titanium.

DIESEL CRANKSHAFT

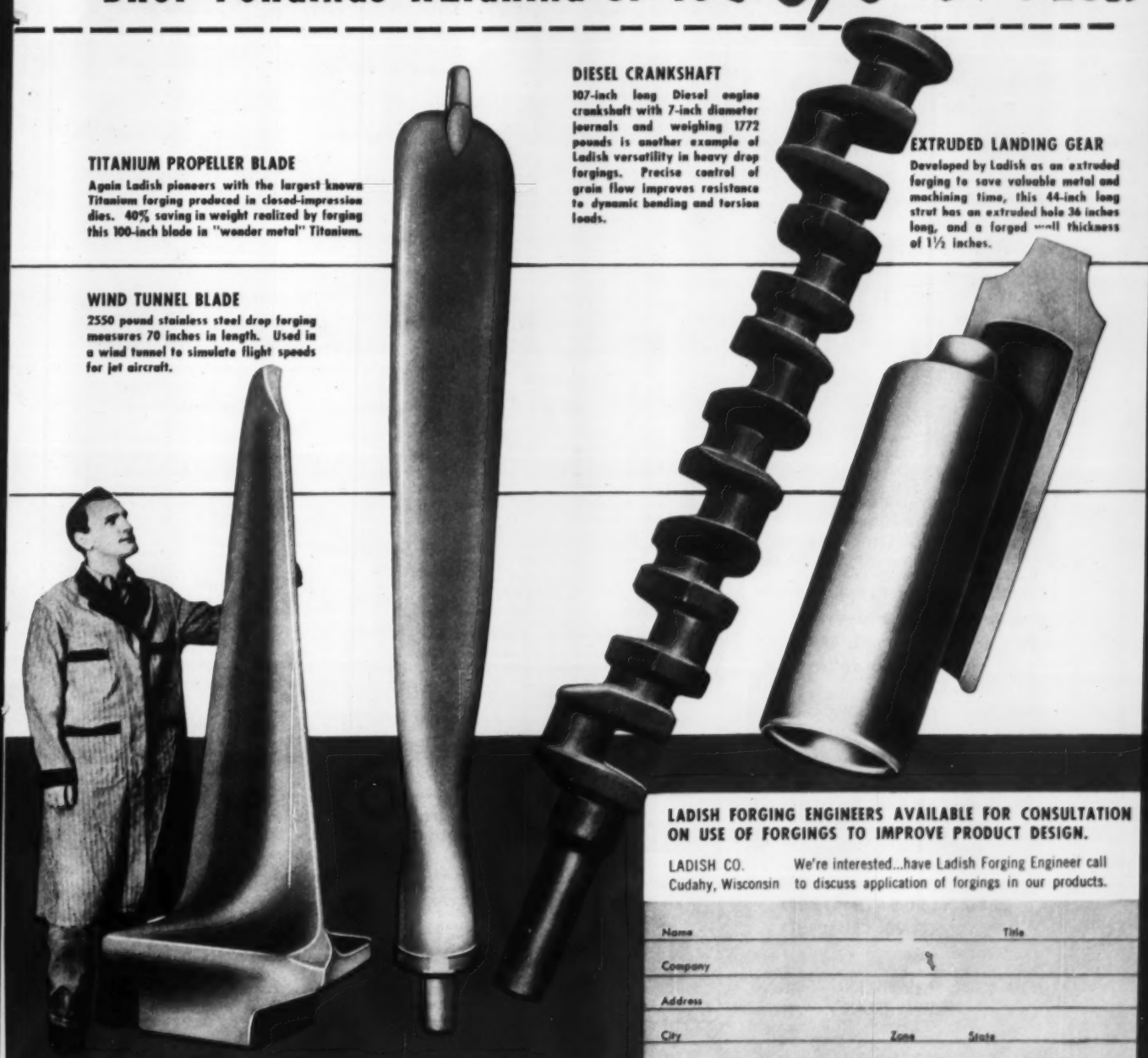
107-inch long Diesel engine crankshaft with 7-inch diameter journals and weighing 1772 pounds is another example of Ladish versatility in heavy drop forgings. Precise control of grain flow improves resistance to dynamic bending and torsion loads.

EXTRUDED LANDING GEAR

Developed by Ladish as an extruded forging to save valuable metal and machining time, this 44-inch long strut has an extruded hole 36 inches long, and a forged wall thickness of 1½ inches.

WIND TUNNEL BLADE

2550 pound stainless steel drop forging measures 70 inches in length. Used in a wind tunnel to simulate flight speeds for jet aircraft.



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LADISH FORGING ENGINEERS AVAILABLE FOR CONSULTATION ON USE OF FORGINGS TO IMPROVE PRODUCT DESIGN.

LADISH CO.
Cudahy, Wisconsin

We're interested...have Ladish Forging Engineer call to discuss application of forgings in our products.

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Company _____

Address _____

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Our Products _____

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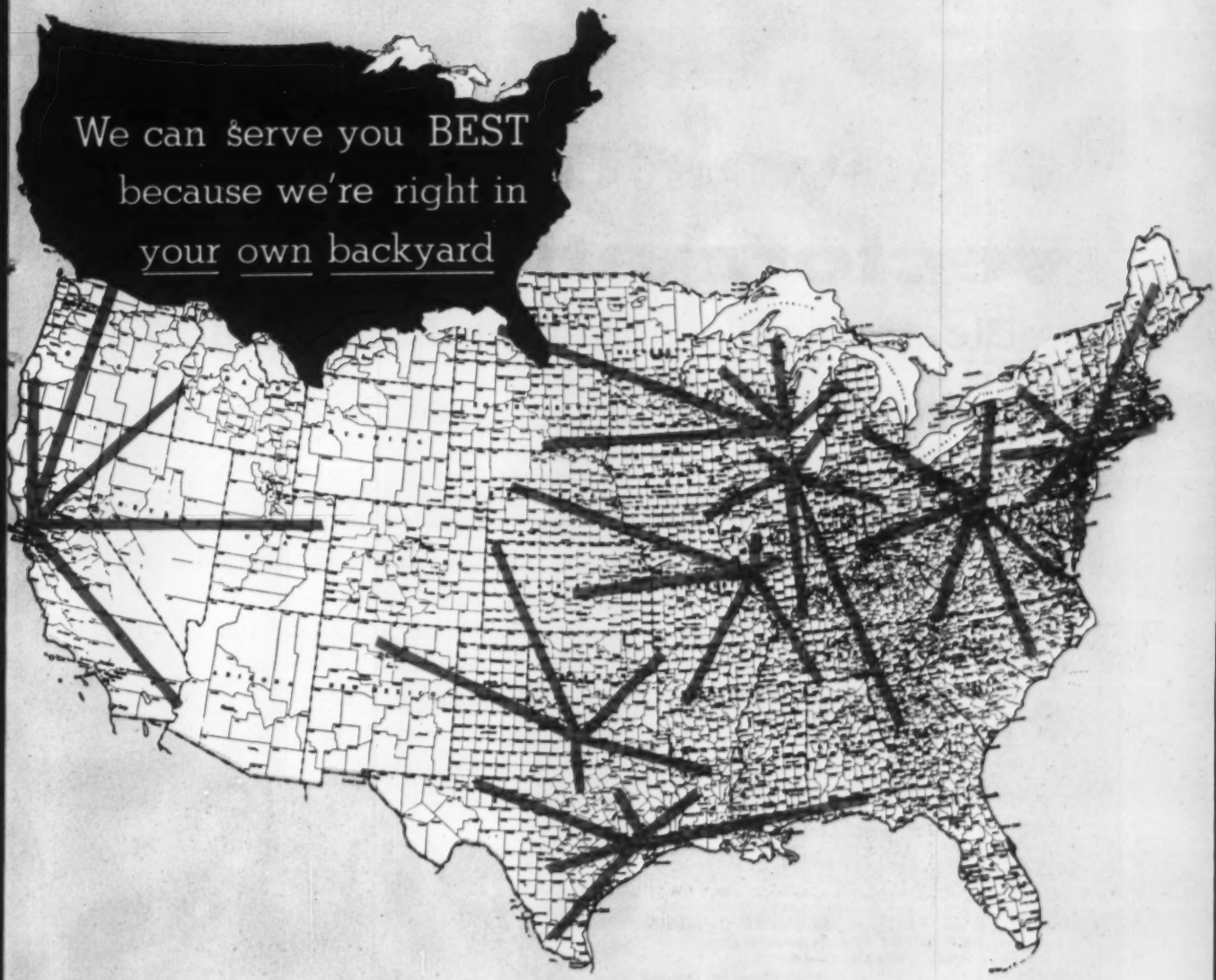

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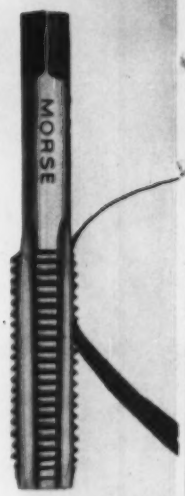

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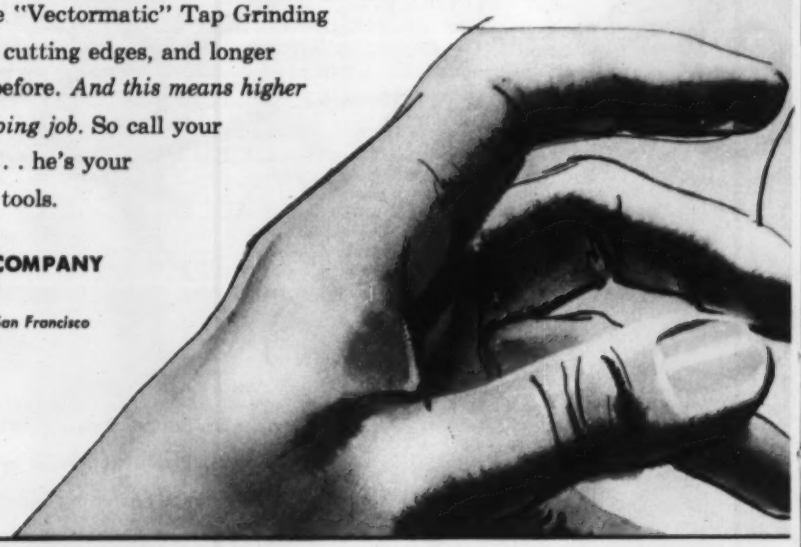
The gaging mechanism is controlled by *an invisible wall of electrons* activating a series of relays. And the control mechanism is unaffected by voltage fluctuations and vibrations.

These and other features of Morse "Vectormatic" Tap Grinding give you far smoother finish, keener cutting edges, and longer tap-life than you have ever known before. *And this means higher production at lower cost, on every tapping job.* So call your Morse-Franchised Distributor *now* . . . he's your only source for these incredible new tools.



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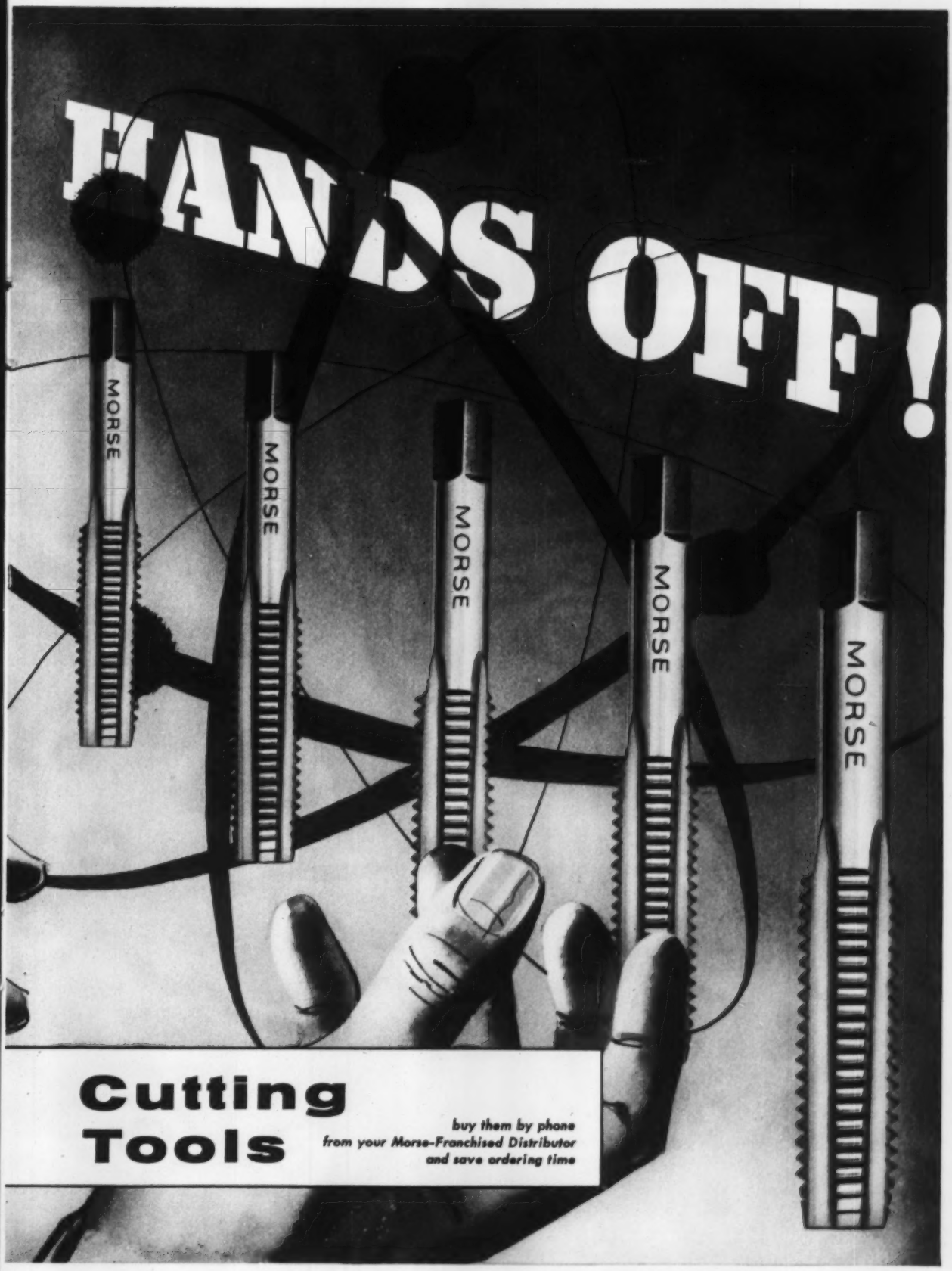
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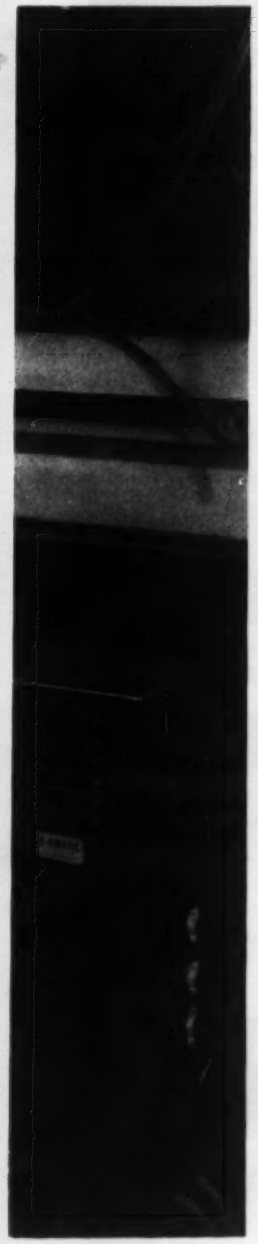
new gas-shielded metal arc process uses Carbon Dioxide to shield the arc



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● **NEW ECONOMY** thanks to use of less-costly Carbon Dioxide . . . thanks to low maintenance requirements of functional design.

● **X-RAY QUALITY WELDS** — Strength and ductility — yours with C-OMATIC.

● **VISIBLE ARC** means faster, easier welding . . . quick, convenient spotting of nozzle. (When required, C-OMATIC is easily convertible to submerged arc, too.)

● **DEEP PENETRATION** further assures high quality welds. No slag to remove . . . no flux to clean up.

● **ACCURATE CONTROL SYSTEM** of constant current design maintains preset arc voltage without fluctuation. No complex electronic circuits! Auxiliary controls available.

● **POWER SOURCE** — The service-proved A. O. Smith d-c rectifier.

Chart illustrates astonishing savings

	HELIUM	C-OMATIC	YOUR SAVINGS		ARGON	C-OMATIC	YOUR SAVINGS
Gas consumption per hour	70 cu. ft.	30 cu. ft.	40 cu. ft.	Gas consumption per hour	60 cu. ft.	30 cu. ft.	30 cu. ft.
Cost of gas per cu. ft.	$0.067	$0.01	$0.057	Cost of gas per cu. ft.	$0.09	$0.01	$0.08
Cost of gas per hour	$4.69	$0.30	$4.39	Cost of gas per hour	$5.40	$0.30	$5.10
Cost per hour 60% of duty cycle	$2.81	$0.18	$2.63	Cost per hour 50% of duty cycle	$2.70	$0.15	$2.55
Cost per day (3 shifts, 22.5 hours)	$63.20	$4.05	$59.15	Cost per day (3 shifts, 22.5 hours)	$60.80	$3.38	$57.42
Cost per year (260 days)	$16,420	$1,053	$15,367	Cost per year (260 days)	$15,780	$878	$14,902

GET ALL THE FACTS NOW! Write for free booklet describing C-OMATIC in detail. Welding Products Division, A. O. Smith Corporation, Milwaukee 1, Wisconsin.

See C-OMATIC in action at the National Metals Exposition in Philadelphia... October 17 to 21... Booth 1842.

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WELDING PRODUCTS DIVISION

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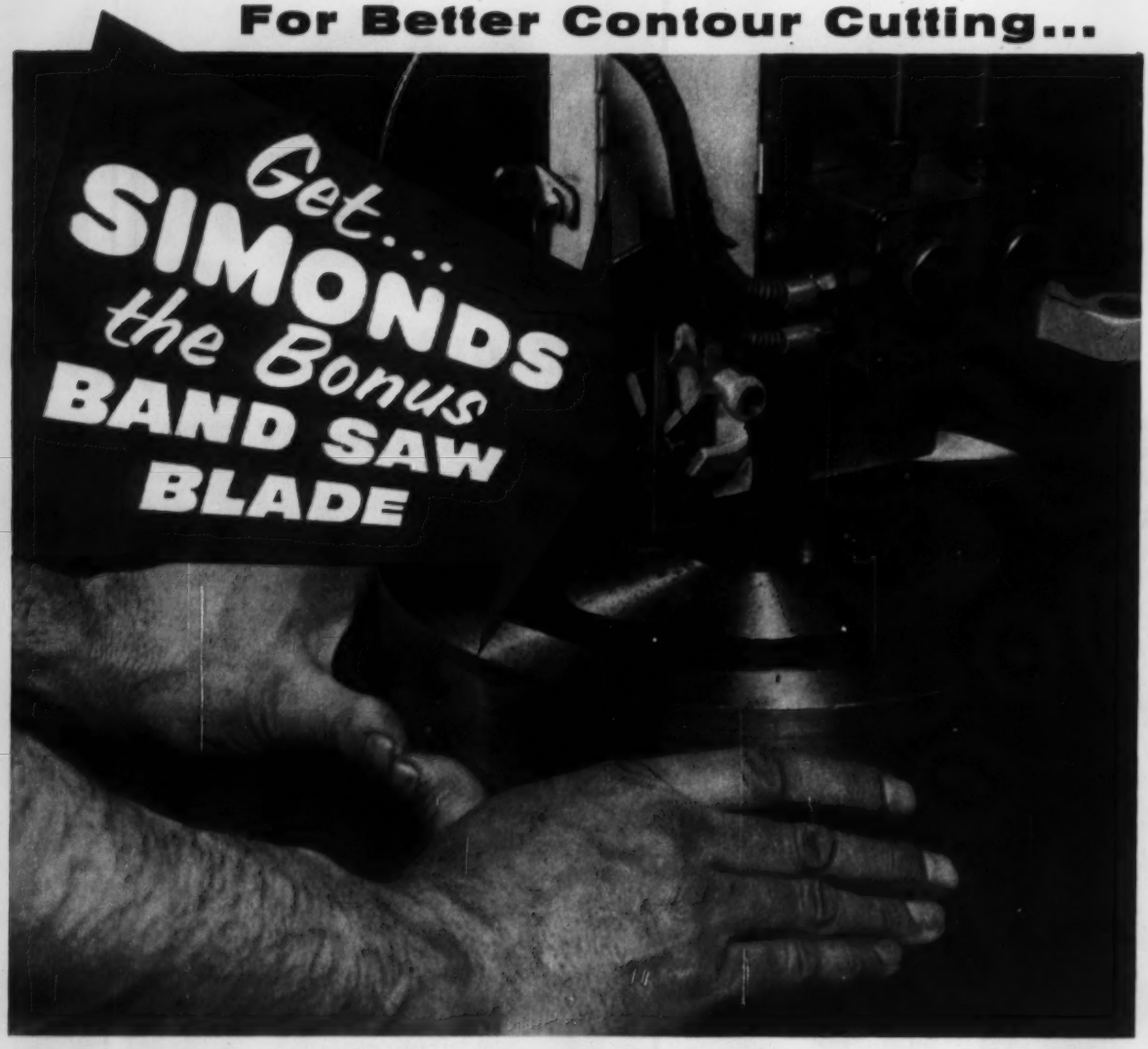

gives you more cuts, longer life, lower costs!

Here's a tough, edge-holding metal cutting band saw blade that gives you a real bonus in smooth, fast cutting and long life.

Made of extra tough, wear-resistant alloy steel, Simonds "Bonus" Bands have sharp, perfectly formed teeth — set with absolute evenness on both sides of the blade. Hardened along the tooth edge only by controlled heat treatment, they combine maximum cut-ability with flexibility and resistance to breakage, provide the ultimate in trouble-free service.

All standard widths and tooth spacings are furnished in 100′ and 250′ coils or welded to specified length. Ask your local Simonds Industrial Supply Distributor for more information on the complete line of Simonds "Bonus" Band Saws.

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Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada

CALENDAR
OF MEETINGS

Oct. 10-12, American Mining Congress: 1955 metal and nonmetallic mining convention, Las Vegas, Nev. Congress' address: 1102 Ring Bldg., Washington, D. C. Executive vice president: Julian D. Conover.

Oct. 10-12, American Society of Lubrication Engineers and American Society of Mechanical Engineers: Joint lubrication conference, Antlers hotel, Indianapolis. Information: American Society of Lubrication Engineers, 84 E. Randolph St., Chicago 1, Ill. Secretary: William P. Youngelaus Jr.

Oct. 10-12, Truck Body & Equipment Association Inc.: Annual convention and exhibit, Morrison hotel, Chicago. Association's address: 1616 K St. N.W., Washington 6, D. C. Executive manager: Arthur H. Nuesse.

Oct. 11-15, Society of Automotive Engineers Inc.: Aeronautic meeting, aircraft production forum and engineering display, Hotel Statler, Los Angeles. Society's address: 29 W. 39th St., New York 18, N. Y. Secretary: John A. C. Warner.

Oct. 12-14, Gas Appliance Manufacturers Association: Annual meeting, El Mirador hotel, Palm Springs, Calif. Association's address: 60 E. 42nd St., New York 17, N. Y. Secretary: H. Leigh Whitelaw.

Oct. 13-15, Foundry Equipment Manufacturers Association Inc.: Annual meeting, the Greenbrier, White Sulphur Springs, W. Va. Association's address: One Thomas Circle, Washington 5, D. C. Secretary: C. R. Heller.

Oct. 14-16, Metal Treating Institute: Annual meeting, Warwick hotel, Philadelphia. Institute's address: 271 North Ave., New Rochelle, N. Y. Secretary: C. E. Herington.

Oct. 16-18, Conveyor Equipment Manufacturers Association: Annual meeting, the Greenbrier, White Sulphur Springs, W. Va. Association's address: One Thomas Circle, Washington 5, D. C. Executive vice president: R. C. Sollenberger.

Oct. 17-18, American Coke & Coal Chemicals Institute: Annual meeting, the Greenbrier, White Sulphur Springs, W. Va. Institute's address: 711 14th St. N.W., Washington 5, D. C. President: Samuel Weiss.

Oct. 17-18, Boston Conference on Distribution: Hotel Statler, Boston. Information: Daniel Bloomfield, director, 80 Federal St., Boston 10, Mass.

Oct. 17-19, American Management Association: Office management conference, Hotel Statler, New York. Association's address: 330 W. 42nd St., New York 36, N. Y. Vice president: James O. Rice.

Oct. 17-21, National Metal Congress & Exposition: Commercial Museum and Convention Hall, Philadelphia. Information: American Society for Metals, 7301 Euclid Ave., Cleveland 3, O. Secretary: W. H. Eisenman.

Oct. 17-21, American Society for Metals: Annual meeting and exhibit, Benjamin Franklin hotel, Philadelphia. Society's address: 7301 Euclid Ave., Cleveland 3, O. Secretary: W. H. Eisenman.

Oct. 17-21, American Welding Society: National fall meeting, Bellevue Stratford hotel, Philadelphia. Society's address: 33 W. 39th St., New York 18, N. Y. Secretary: J. G. Magrath.

Oct. 17-21, Society for Nondestructive Testing: Fall technical meeting, Sylvania hotel, Philadelphia. Society's address: 1109 Hinman Ave., Evanston, Ill. Secretary: Philip D. Johnson.

Oct. 17-21, National Safety Congress & Exposition: Conrad Hilton, Congress, Morrison and LaSalle hotels, Chicago. Information: R. L. Forney, general secretary, National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

Oct. 18-19, American Management Association: Special packaging conference, Hotel Commodore, New York. Association's address: 330 W. 42nd St., New York 36, N. Y. Vice president: James O. Rice.

Oct. 19-20, American Society of Mechanical Engineers: Fuels-coal conference, Neil house, Columbus, O. Society's address: 29 W. 39th St., New York 18, N. Y. Secretary: C. E. Davies.

At your service...

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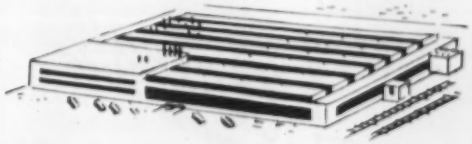
complete machines, assemblies, sub-assemblies, machine parts



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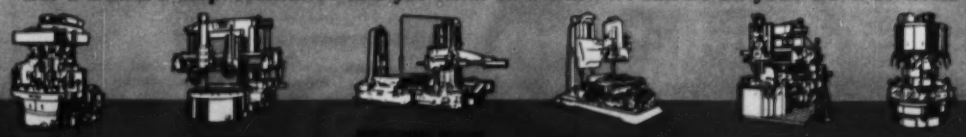
Let a Bullard Representative analyze what this machine can do on your work or write to



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How many push-ups in a STAINLESS TUBE?

Courtesy: American District Steam Co., Inc.

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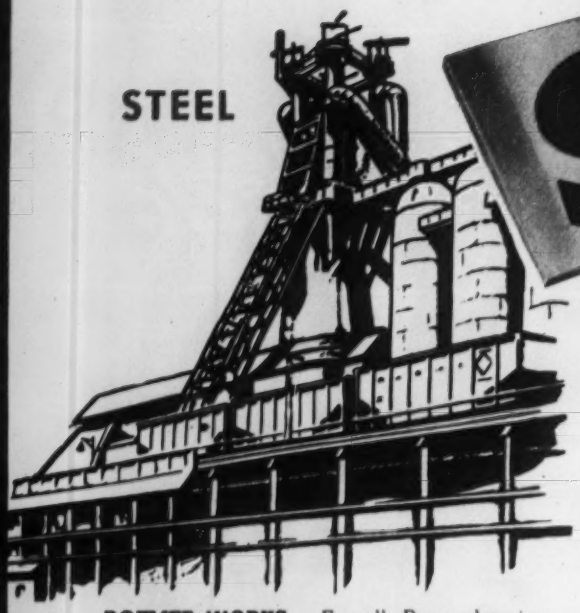

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Steel Manufacturing Division: Pig Iron, Open Hearth Ingots, Blooms, Slabs, Billets, Sheet Bar and Plates. Finishing Division: Carbon, Alloy and Stainless Hot and Cold Rolled Strip Steel, Black, Pickled and Coated Strip Steel, Sharon Galvanite* Sharonart, Special Alloy Coated, N. A. X. and Cor-Ten Strip Steels.

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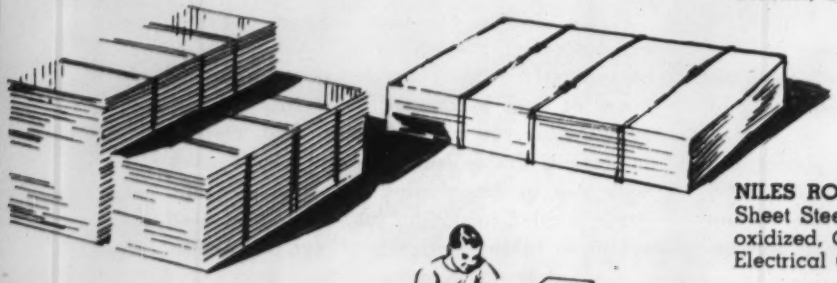

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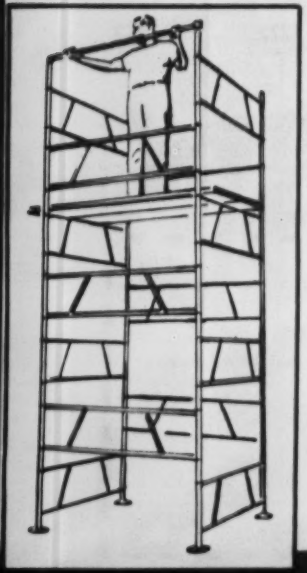

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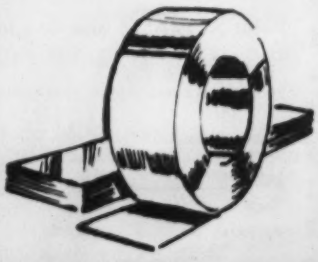

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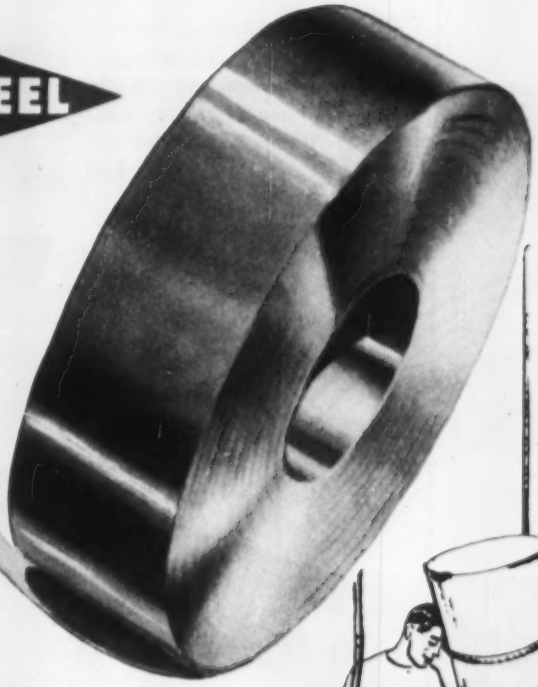
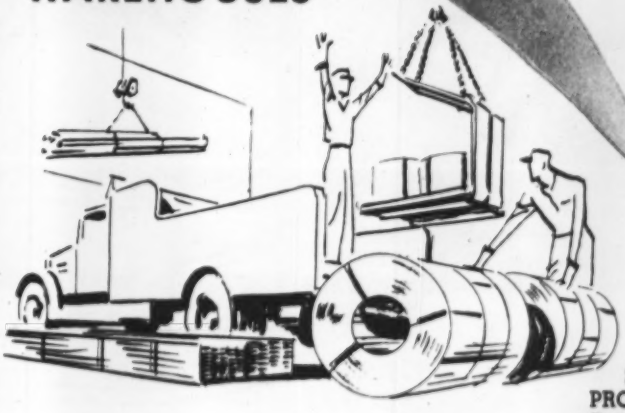
SHARONSTEEL

STEEL



WAREHOUSES



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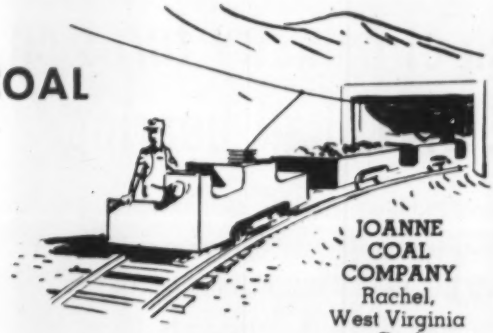

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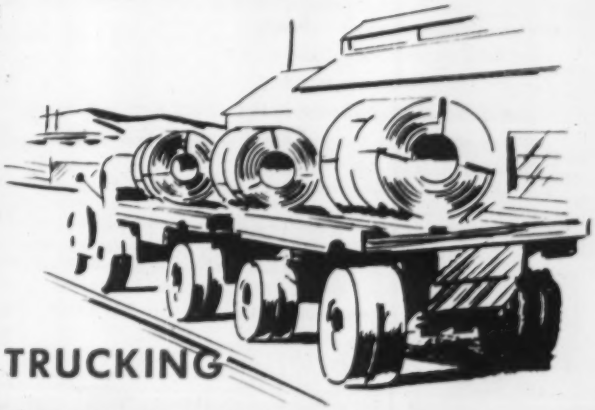

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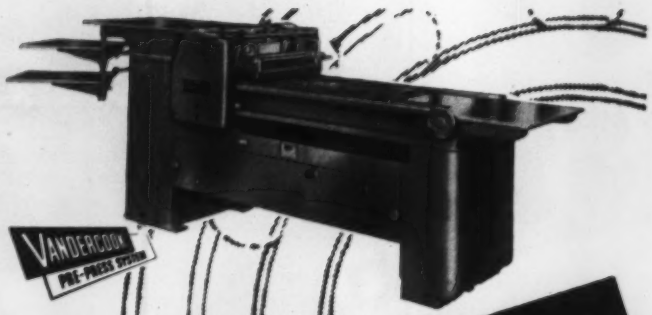
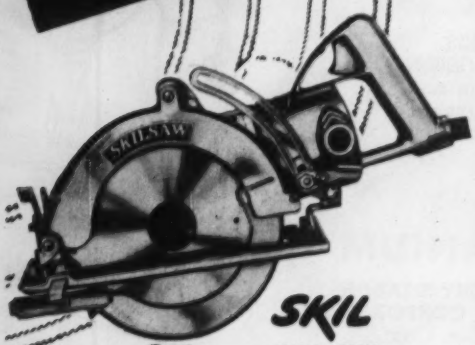
Color printing demands exacting precision, vibration-free press performance for accurate register of one color to the next. You'll find Federal Bearings here, too.



in the workshop . . . or the print shop



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In hobbyists' tools and home appliances—in pressrooms and mass-production plants—in farm equipment and business machines—you'll find Federal Ball Bearings quietly and efficiently at work, in some of the hundreds of types and 12,000 sizes that the company has been producing for almost 50 years devoted *only* to making ball bearings.

When Federal Ball Bearings are a part of so many things you *use*, shouldn't they be a part of the things you make?

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Sandvik Steels have a record of success in applications which demand years of consistent, continuous performance.

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If your product requires high fatigue life, fine surface finish, uniform physical properties and accurate gauge, try Sandvik.

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Ask your nearest Sandvik office for further information or technical assistance.

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SANDVIK SWEDISH SPECIALTY STRIP STEELS

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SIMPLEX nitrogen-bearing, low-carbon ferrochrome—in 2% and 5% nitrogen grades.

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Electrolytic chromium metal—with minimum chromium content of 99.00%.

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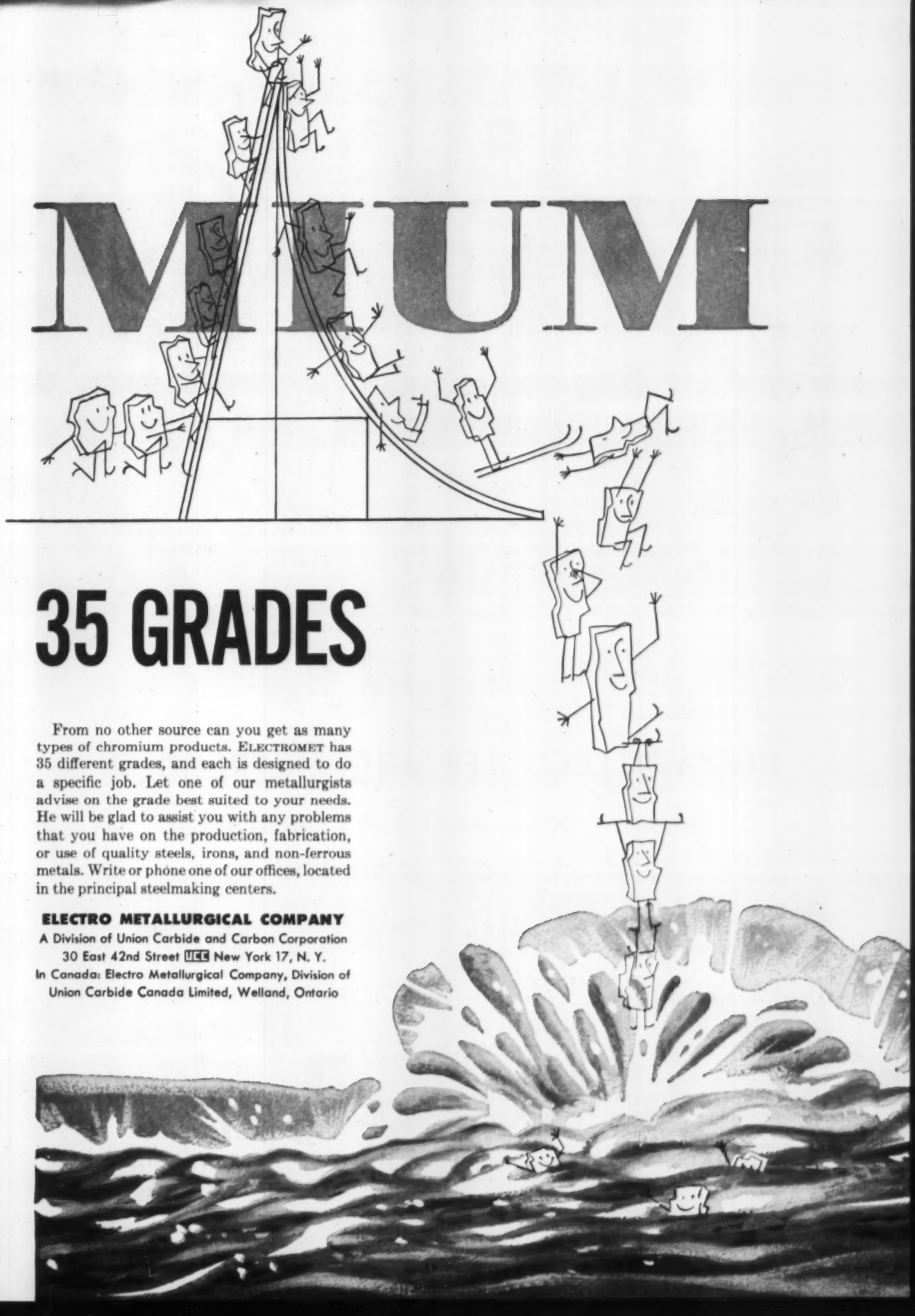
The terms "Electromet," "Simplex," and "SM" are trade-marks of Union Carbide and Carbon Corporation.



35 GRADES

From no other source can you get as many types of chromium products. ELECTROMET has 35 different grades, and each is designed to do a specific job. Let one of our metallurgists advise on the grade best suited to your needs. He will be glad to assist you with any problems that you have on the production, fabrication, or use of quality steels, irons, and non-ferrous metals. Write or phone one of our offices, located in the principal steelmaking centers.

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A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
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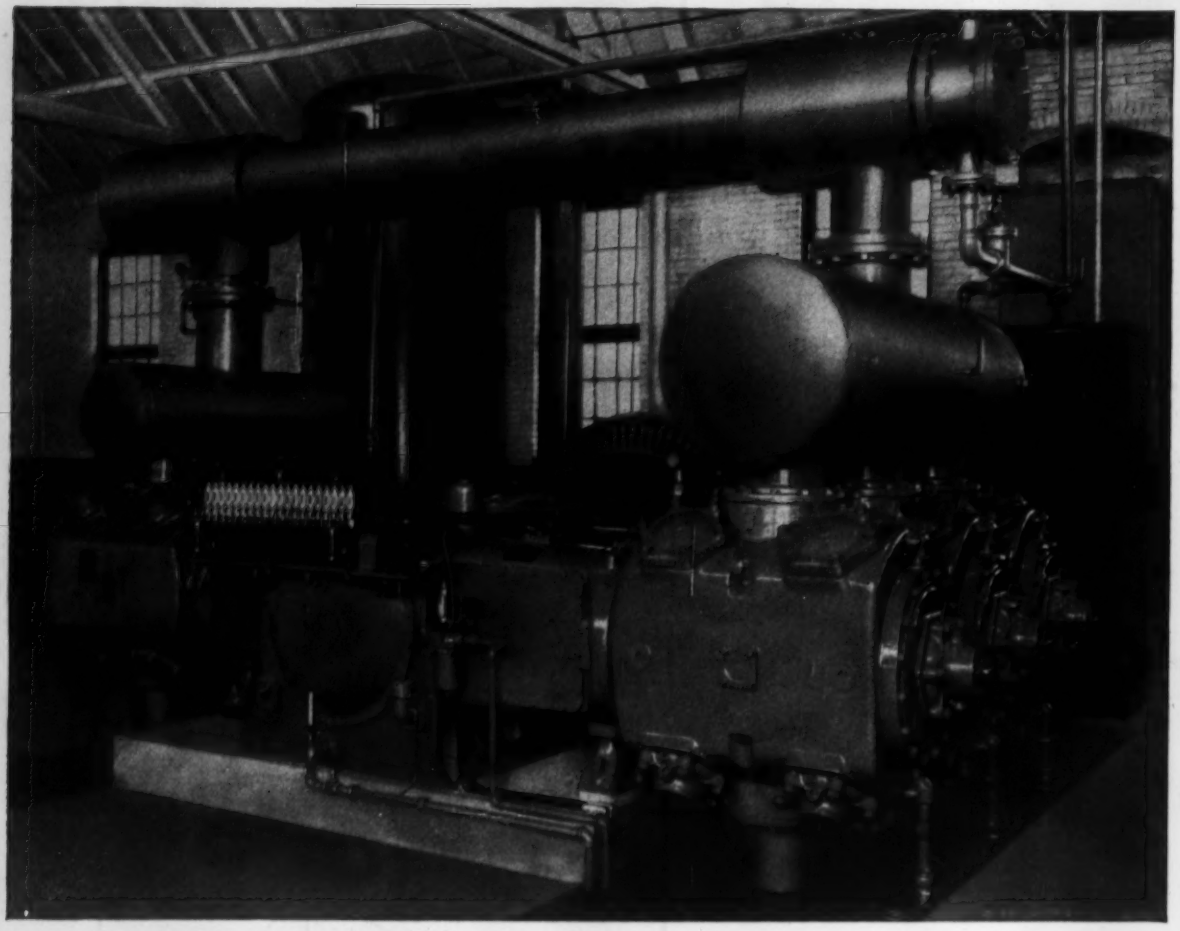

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teamed with 800 HP compressor to deliver air clean and dry

Delivering industrial air in a well-known electric range manufacturing plant, this 800 hp motor-driven compressor is equipped with a Ross Intercooler and a Ross Aftercooler.

Clean, dry compressed air is thus assured . . . at all times!

Rated first for heat exchange efficiency by compressor builders and users alike, Ross Cylinder-Mounted-Intercoolers, Aftercoolers, Lube Oil Coolers and Jacket Water Coolers are ruggedly constructed for long, economical service. Available in a wide range of standardized designs, they can be delivered promptly to meet most needs.

To see how Ross Exchangers can be used to meet *your* needs profitably, merely furnish a brief description of your compressors and their applications. Detailed literature will be mailed to you promptly, without obligation.

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MATTISON
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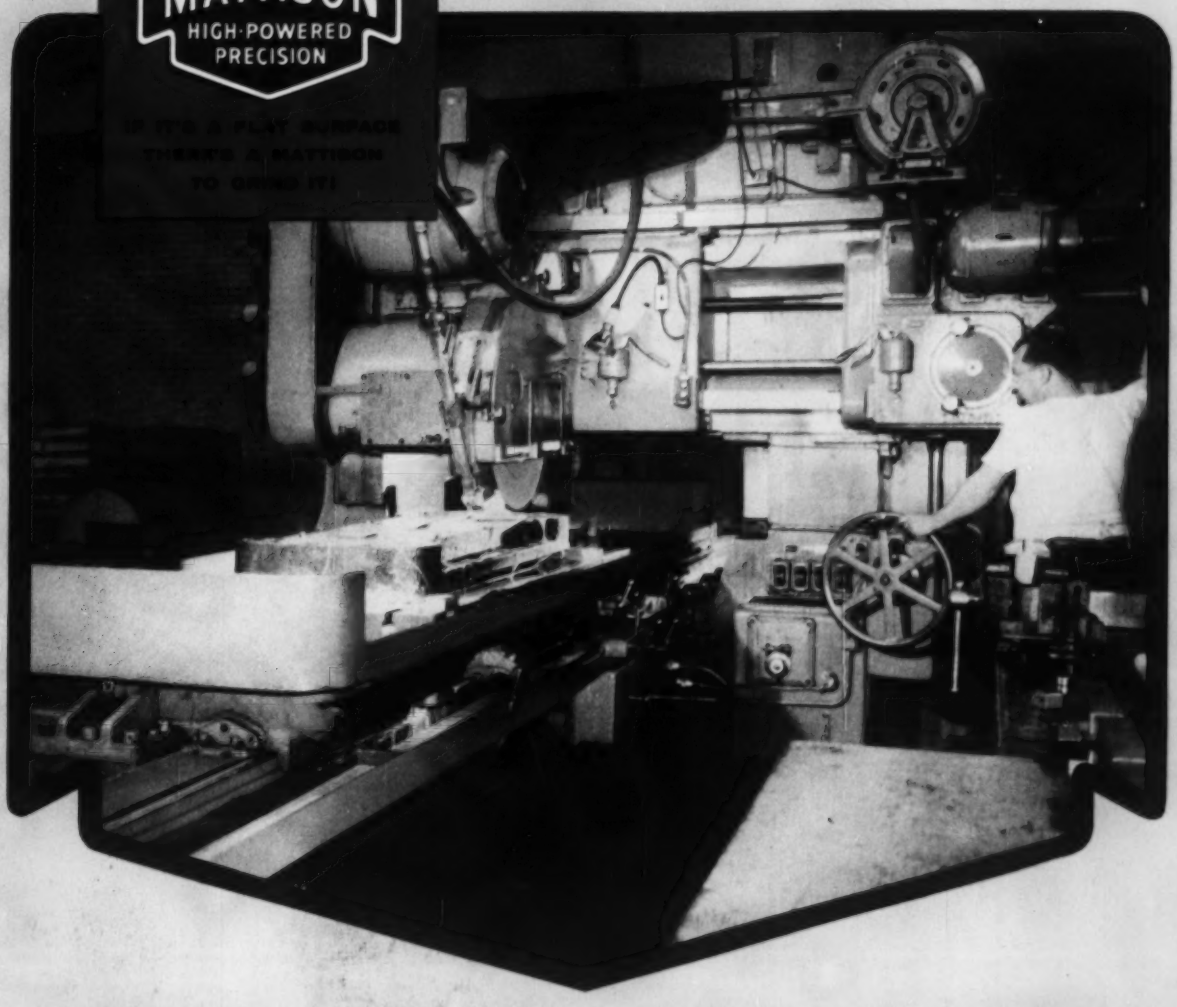
PRECISION

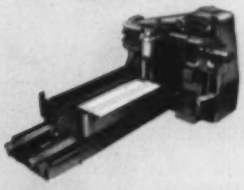
IF IT'S A FLAT SURFACE
THERE'S A MATTISON
TO GRIND IT!



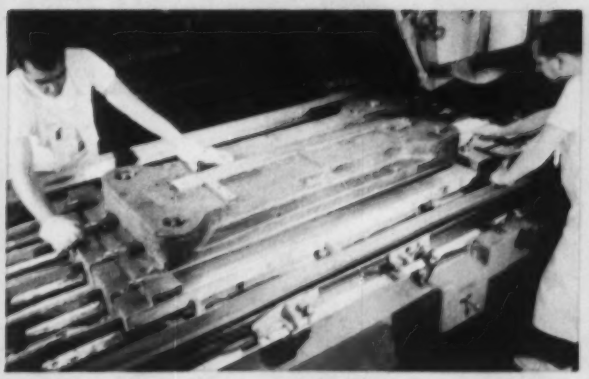
GRINDING METHODS

Accuracy upgraded from .006" to .0003", sharpening large blanking dies on the "Plano"

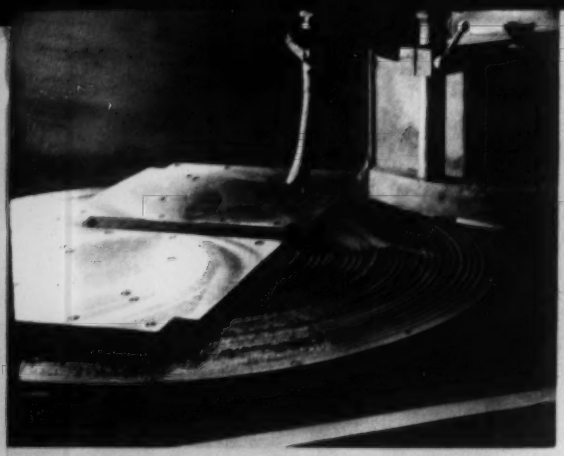
Improved precision, not increased production, was the primary goal of this user of a Mattison Plano Horizontal Spindle Surface Grinder. Yet, experience proved it possible to achieve both. One precision job ground on the machine is a male blanking die of high carbon, high chrome Ontario steel. Accuracy is maintained to .0003 in. compared to .006 in., which was the closest tolerance obtained on the previous equipment.



Floor-to-floor time for grinding the die has been reduced from 3 hours to 1½ hours on the Plano. Improved finish is another notable benefit gained.



The Plano Grinder features massive, rugged construction and high horsepower characteristic of the entire Mattison line. It is unexcelled for grinding flat and "V" ways; long, narrow work; large, flat work; surface tables; plates; dies; jigs; and similar work. Write for Bulletin No. 345.



"High power" increases production 100% grinding hardened steel plates

Ask your Mattison dealer to show you the seven points of superiority of the No. 24 and 36 Rotary Surface Grinders.

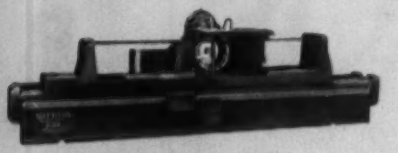
Inaccuracy at any machining station in a transfer machine can cause trouble at every succeeding station—here's how Mattison's high horsepower, integral base and column assembly, and long, wide head slide ways prevent that trouble. One manufacturer uses a Mattison No. 36 Rotary Surface Grinder to grind subplates for a transfer machine built for an automobile maker. This plate, of 1019 steel and 50-60 Rockwell C hardness, is 19½ in. square with four milled pads on its base side. A light pass is made over the pads, after which the plate is reversed and the flat surface ground. Stock removal is .125 in., the plate must be flat within .002 in., and parallelism is held to within .001 in. The user reports that it would take 100 per cent longer to grind these subplates on a competitive make of grinder. Bulletin No. 146 describes the Mattison Rotary Surface Grinder line.

ASK FOR THE RIGHT GRINDER FOR YOUR JOB FROM MATTISON'S COMPLETE LINE OF

Face grinding surfaces of connecting rods accurately at high production rate

Precision grinding was an essential requirement in production of engine connecting rods at Caterpillar Tractor Co. Installation of a High-Horsepower Mattison Traveling-Table Face Grinder, with automatic feed, made possible accurate grinding of the matching surfaces at a high production rate. Rods and bearing caps are held in place by a hydraulically operated fixture.

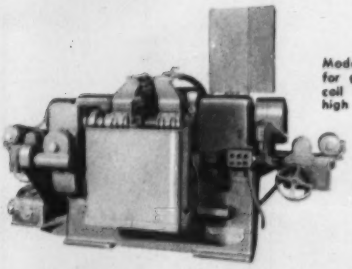
Mattison Face Grinders offer the advantages of high-horsepower and rigid construction for production, toolroom, and maintenance grinding. Bulletin 846-2RM describes the complete line.



3200 Alnico magnets per hour on this fully automatic double-disc grinder

Production rate of Alnico magnets is 3200 per hour (both ends ground) on this Mattison Model 221 Double Spindle Disc Grinder, with one operator. Former method needed two operators and rate was only 500 per hour (both ends ground). Workpieces shown are .684 in. long by .460 in. diameter and extremely hard and brittle. Magnets are loaded into automatic feed hopper and stock removal is .024 in. to .030 in. on the over-all length. This dimension must be held to ± .001 in. with a 25 to 30 microinch finish.

Mattison Double Spindle Disc Grinders offer the best method of finishing opposite faces flat and parallel simultaneously. They provide high output per hour, combined with extreme accuracy and savings in time and cost. Six machines are available ranging from 10 in. to 30 in. disc wheel capacity—from 1½ to 50 hp. Automatic feed mechanisms of many types may be used, depending on production requirements.

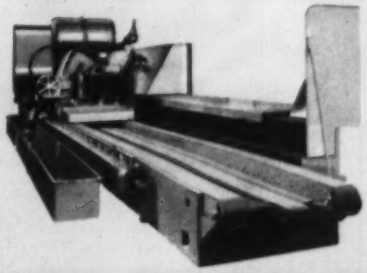


Model 221 is often used for grinding piston rings, coil springs, and similar high production jobs.

SO DIFFERENT MACHINES • SURFACE GRINDERS • FACE GRINDERS • DISC GRINDERS

$3500 saved yearly by grinding heat exchanger shell flanges

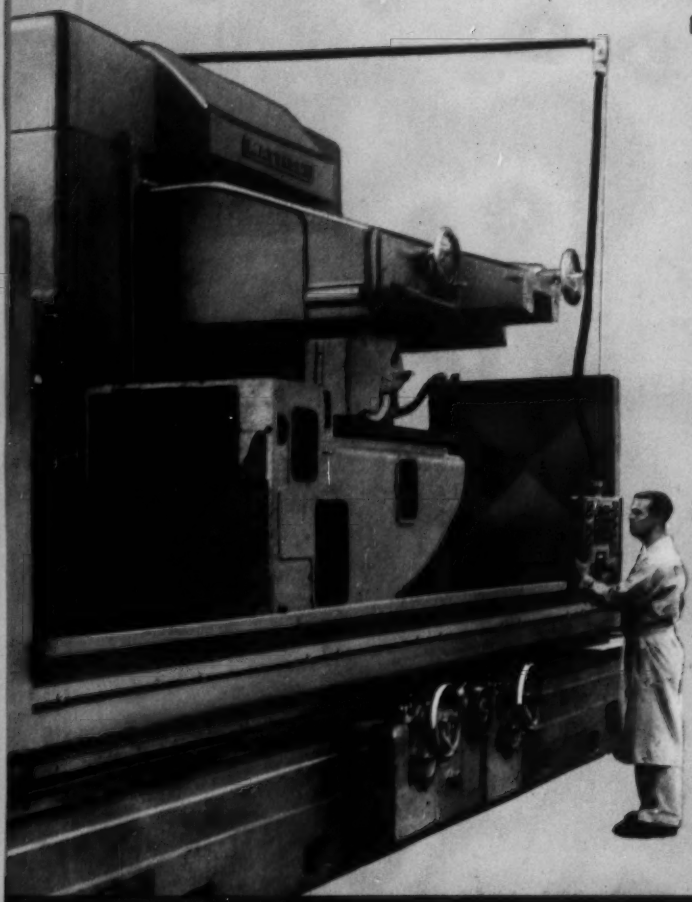
Grinding shell flanges and shell covers for heat exchangers on Mattison No. 500 Traveling Wheel Grinder saves approximately $3500 annually in stock removal for this user. To insure tight, leakproof fit, surfaces of the shell flange (carbon steel) and shell cover (cast steel) are ground to 65 to 70 microinch finish with stock removal of .062 in. Flatness is held within .003 in. Send for Bulletin 844 describing Mattison Traveling Wheel Grinders.



Grinding long and bulky parts with speed and accuracy is simple job for traveling wheel grinder.

MATTISON
HIGH-POWERED
PRECISION

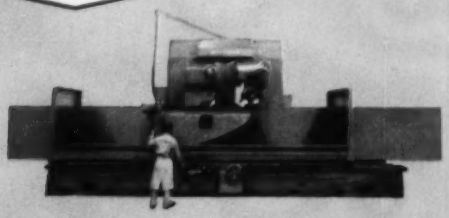
GRINDING METHODS

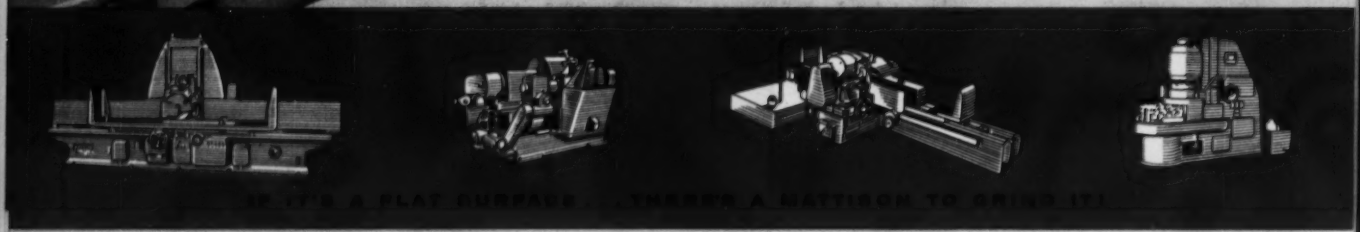


New "single-setup" method for grinding large machine tool castings

No time-consuming, costly rehandling of large machine tool castings when they are ground on the new Mattison Combination Way and Surface Grinder. Independent vertical and horizontal spindles allow grinding "V" and flat ways, dovetails, shoulders, radii, and contours in a single setup with maximum precision. Two or more surfaces can be held in exact relative alignment. Massive three-column construction permits heavy stock removal, with fine finish. Pendant control governs all operations of the machine, simplifying the operator's job.

Bed castings, columns, tables, slides, saddles, and heads can now be ground speedily with precision.





IF IT'S A FLAT SURFACE . . . THERE'S A MATTISON TO GRIND IT!

Send parts to Mattison Methods Laboratory for sample grind and production estimate

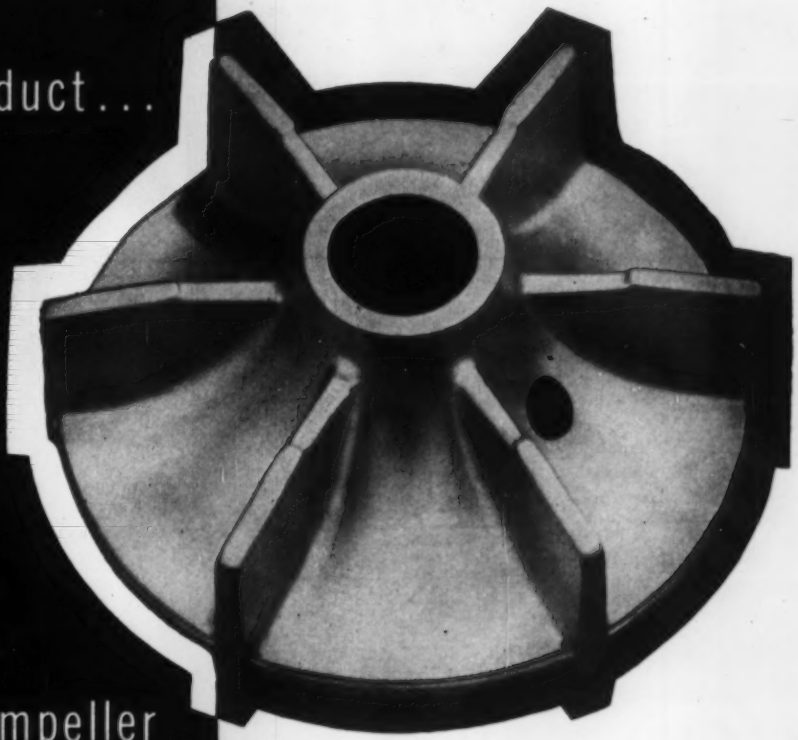
The Mattison Methods Laboratory . . . equipped with all major types of modern surface grinders, face grinders, and disc grinders . . . introduces a new service to metalworking plants. You are invited to submit parts for sample grinds, production estimates, wheel recommendations, and other production requirements. Please include part prints, operation or route sheets, and all special requirements for machining your piece-parts. You'll get a comprehensive report based on close duplication of field conditions. With a line of 50 different grinders for production and toolroom work, Mattison can specify machines that meet your needs *precisely* . . . and give you maximum accuracy, productivity, and economy.

MATTISON
MACHINE WORKS
ROCKFORD, ILL. U.S.A.

HIGH-POWERED PRECISION SURFACE GRINDERS

MATTISON MACHINE WORKS
ROCKFORD, ILLINOIS

another case where
MUELLER BRASS CO.
FORGINGS
improve a product...



diesel engine
water pump impeller
forged of **"603" HIGH STRENGTH BRONZE**

Formerly produced as sand castings, these impellers now give better results because they're forged from "603" high strength bronze by the Mueller Brass Co. Said to be "right for the job and far superior to the old cast impellers", these forgings bring greater efficiency and longer life to the diesel engine water pumps in which they are installed. This tough "600" series alloy is readily forgeable, possesses remarkable resistance to corrosion, and has fine bearing qualities. Uniformity is excellent, due to the closer dimensional control of the forging process, and surface finish is noticeably smoother. This is another case where Mueller Brass Co. forgings have greatly improved a product . . . why not let our engineers show you the many advantages of using forgings.

STREAMLINE PRODUCTS

MUELLER BRASS CO.

PORT HURON 19, MICHIGAN

ROCKFORD, ILLINOIS

Has any Cold Drawn Finish ever "made good" so fast!

LUSTERIZED
TRADE-MARK
FINISH

IN FEBRUARY 1955, we shipped the *first* order of LUSTERIZED FINISH from our Harvey plant.

Now this premium product is available from *all* 4 B&L plants.

More than 70% ... of our total Cold Drawn tonnage is being shipped to customers who specify LUSTERIZED FINISH on their orders.

BLISS & LAUGHLIN, INC.

GENERAL OFFICES: HARVEY, ILLINOIS

SALES OFFICES IN ALL PRINCIPAL CITIES

FOUR PLANTS:—

HARVEY, ILL.

DETROIT, MICH.

BUFFALO, N. Y.

MANSFIELD, MASS.

JACK & HEINTZ

Saves $15.84 per hour...

Jack & Heintz Inc. silver brazes over 25 different parts on this 15 KW, 10,000 cycle TOCCO machine.

with TOCCO* Induction Brazing

Brazing Costs Down

When Jack & Heintz engineers switched from torch brazing to automatic induction, brazing cost of these inverter brush mounts fell from $.05 to $.006 each —a reduction of 83% in direct labor costs alone! Additional savings result because less cleaning is required after TOCCO, and fuel costs are much lower, too.

Brazing Production Up

While costs dropped, production on the part zoomed —from 40 to 360 brazed assemblies per hour. Furthermore, rejects and scrap, formerly high, are now negligible.

Versatility

The part shown is just one of over 25 parts, large and small, which alert J & H engineers have converted from old-fashioned brazing methods to modern, automatic TOCCO. Overall brazing costs (TOCCO brazing versus former methods used) are down 75%—brazing speed, up 100%.

* * *

If the manufacture of *your* product involves brazing, heat-treating, forging or melting of ferrous or nonferrous metals, don't overlook TOCCO as a sound method of increasing production, improving product quality and slashing costs.

THE OHIO CRANKSHAFT COMPANY

TOCCO

Mail Coupon Today

NEW FREE BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. 5-10, Cleveland 5, Ohio

Please send copy of "Typical Results of TOCCO Induction Brazing and Soldering".

Name_____

Position_____

Company_____

Address_____

City_____ Zone____ State____

CINCINNATI SHEARS hold accuracy at high speeds...

at **THE HOELTGE BROS., INC.**
Cincinnati, Ohio

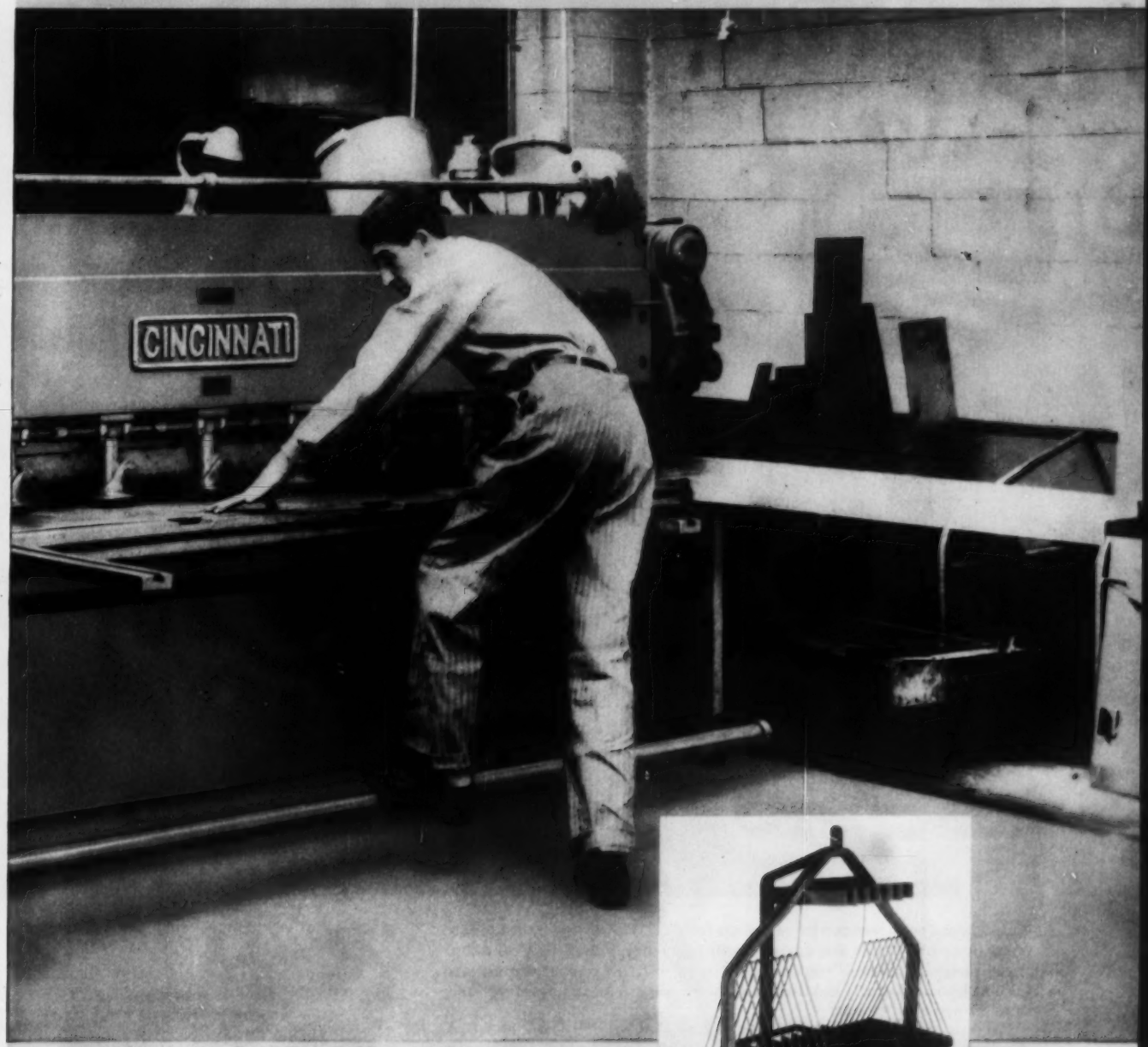
For seven years, this Cincinnati Shear has given trouble free performance on manufacturing and jobbing work, blanking 3/16" and lighter steel sheets.

These Cincinnati features are profitable at Hoeltge Bros.:

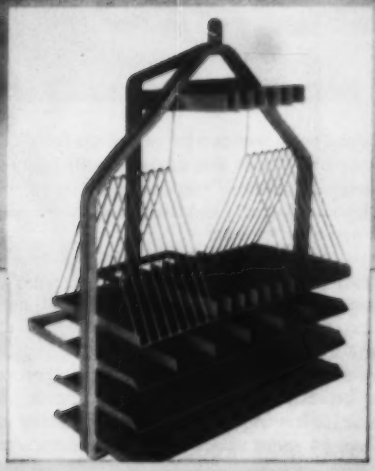
- Hydraulic holddowns.
- Four-edged knives.
- Accurate back gauge.
- Easy operator control.

Save time with a Cincinnati Shear. They cut materials of various thicknesses without changing knife clearance.

Investigate these money making Cincinnati Shears. Write for Catalog S-7.



Photos courtesy Hoeltge Bros., Inc., Cincinnati, Ohio.

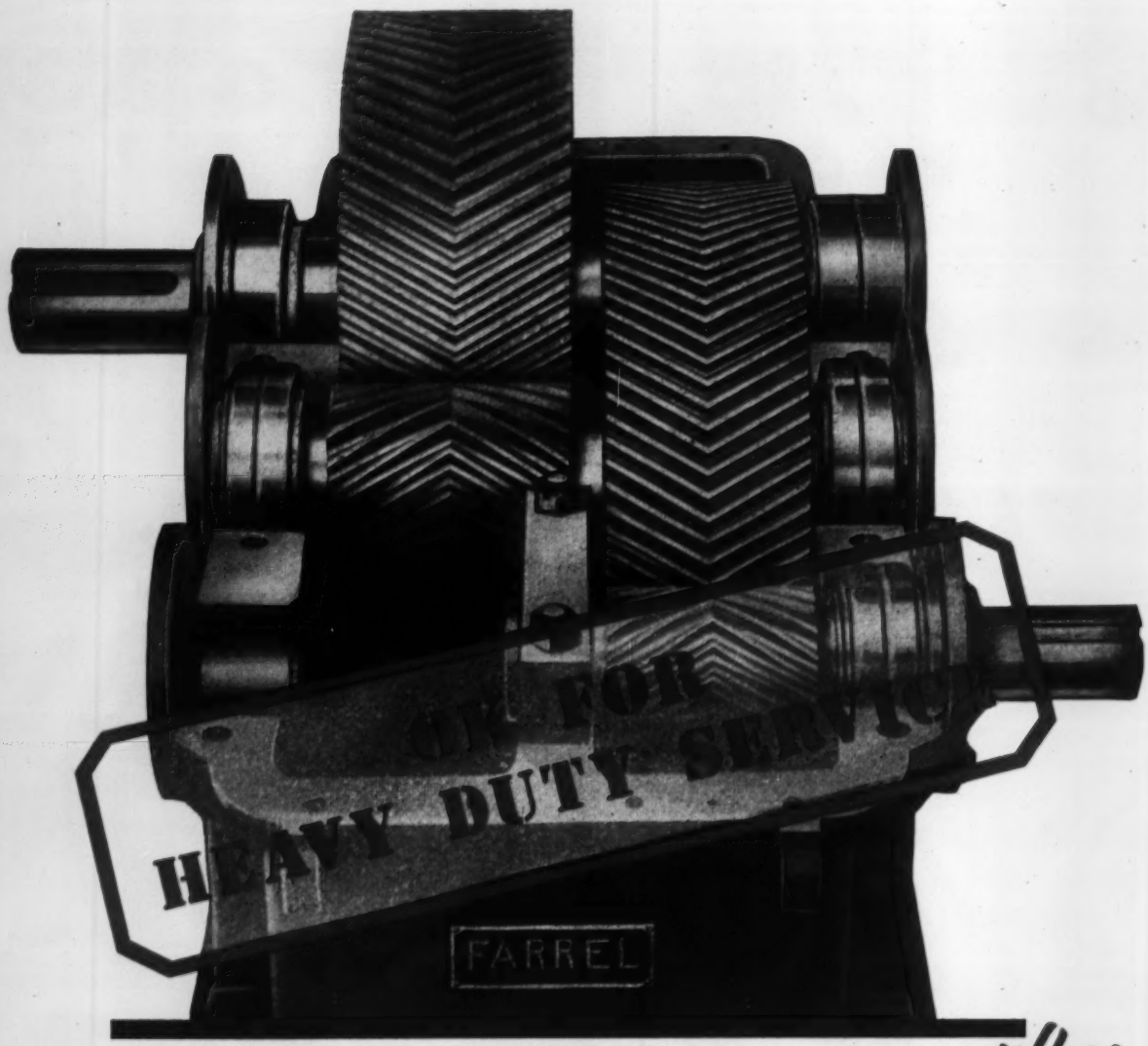


4′ x 3′ x 2′ Overhead Conveyor carrier.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI



Farrel speed reducers can be relied on for dependable operation where conditions of service are unusual and exacting. The ability to adapt these units to specific requirements results from design experience gained by successfully solving innumerable problems requiring freedom in gear judgment.

To suit the application, the gears and pinions of Farrel speed reducers can be proportioned to meet specific load, speed and service conditions . . . input and output shafts can be varied in size, in material and in extension . . . housing dimensions can even be changed to meet problems in mounting.

Farrel supplies these units in a wide range of ratios and capacities. Designs include single, double, and multiple reduction units, speed-change units having two or more selective speeds, right angle drives, and drives to meet special requirements. Ask for Bulletin 449.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Boston, Akron, Pittsburgh, Detroit, Chicago, Memphis, Minneapolis, Fayetteville (N.C.), Los Angeles, Salt Lake City, Tulsa, Houston, New Orleans

Farrel-Birmingham ®

Here's Why

1. **PRECISION GEARS** have teeth generated by the famous Farrel-Sykes method—a process that assures accuracy of tooth spacing, profile and helix angle.
2. **OVERSIZE SHAFTS** are large for the power to be transmitted, giving added stiffness against bending and torsional deflection under peak loading variations.
3. **HIGH CAPACITY ROLLER BEARINGS** take radial and normal thrust loads, hold the shafts in precise alignment.
4. **CONTINUOUS SPLASH LUBRICATION** reliably supplies oil to all bearings and gear teeth.
5. **STURDY HOUSING** holds rotating elements in original alignment, preserves operating smoothness of the gearing.

EASTERN TOOL AND STAMPING CO., Inc.

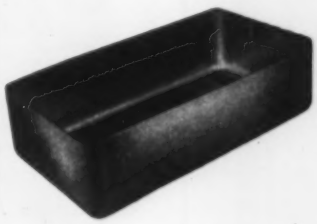
Typical example of 1-piece stamping from 1/8" thick by 7 3/4" diameter brass blank.

Here is a one-piece stamping that makes up into a hand stapler part.

STAMPING SPECIALISTS IN DEEP DRAWING WORK - ALL METALS - ALL INDUSTRIES

Brass Box—5" deep—14" square—17 3/8" Flange.

Spring tempered phosphor bronze contact—note flat foldback feature.



Aluminum Casing — 4 3/4" deep — 9 1/8" wide—16 3/4" long.

Steel Machinery Part—7 1/4" deep —10" dia.

Headlight—6 1/4" deep—7 3/4" O.D.

Notice the reduction in this 4 1/8" long by 1/2" O.D. tube with 1 1/8" flange.

ETS

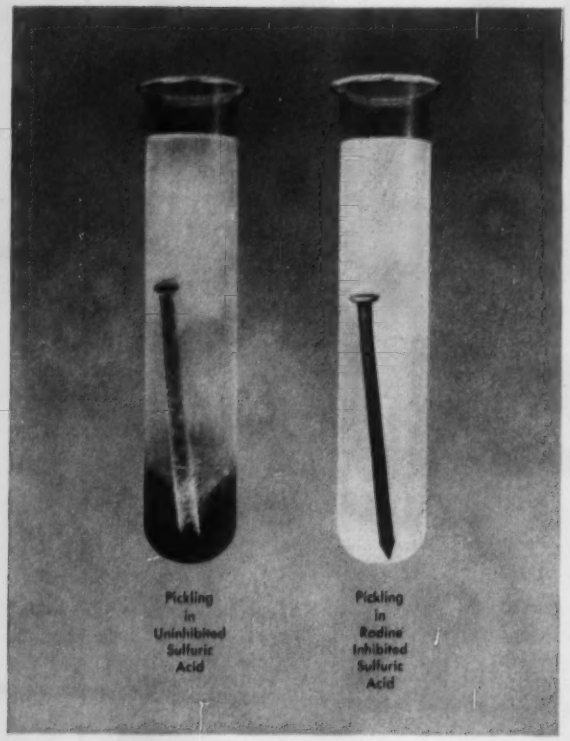
EASTERN TOOL AND STAMPING CO., Inc.

PRESSED METAL ENGINEERS
DIES AND STAMPING
110 BALLARD ST., SAUGUS, MASSACHUSETTS

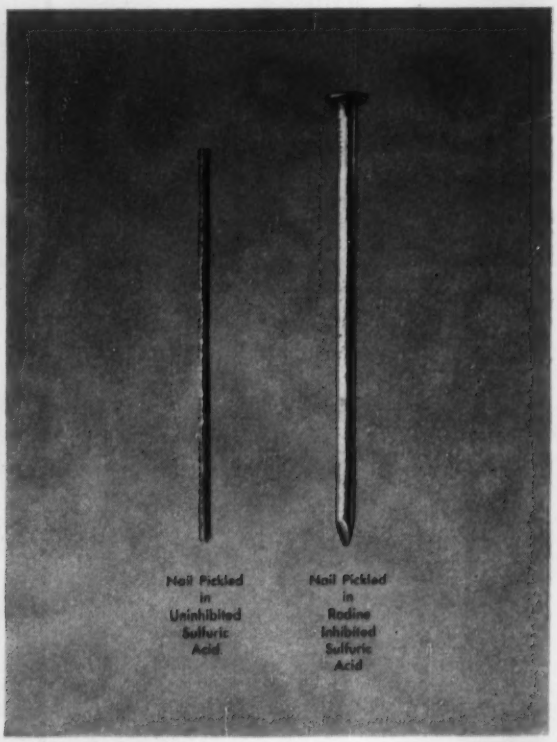
HOW RODINE® CUTS PICKLING COSTS

Tests demonstrate the effectiveness of Rodine in retarding the attack of acid on the metal

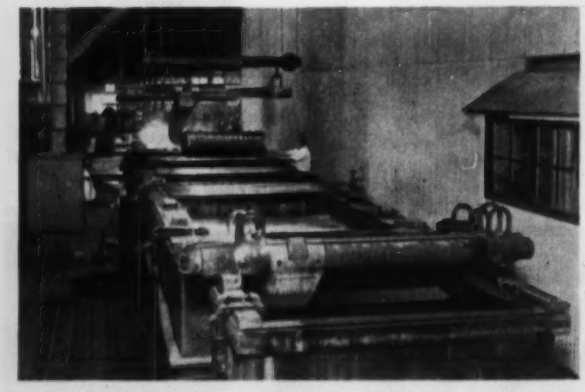
Rodine pickling acid inhibitors retard the attack of the acid on the metal without affecting the ability of the acid to remove scale. Their effectiveness in saving acid and metal is demonstrated by these two simple tests:



Formation of Hydrogen Test. Both test tubes contain a 10% by volume solution of sulfuric acid. In the left-hand tube, the acid is uninhibited. In the right-hand tube, a Rodine inhibitor has been added in an amount equal to 1% by volume of the concentrated acid. There is no bubbling in this tube—Rodine has retarded the formation of hydrogen that is the result of acid dissolving steel.



Loss of Weight Test. Both nails have been pickled in a 10% by volume solution of sulfuric acid for the same length of time. The nail pickled in the uninhibited sulfuric acid solution has lost its form, does not look like a nail any more. The nail pickled in the sulfuric acid solution with Rodine added has lost little weight, has retained its shape and luster.



Rod and wire, tube and sheet are pickled clean with Rodine, without wasting either acid or metal—there are fewer rejects, which means big savings.

Not only does Rodine save metal and acid, but it improves the quality of the pickled product as well. And baths containing Rodine can be operated longer with less acid required to keep them at the desired concentration.

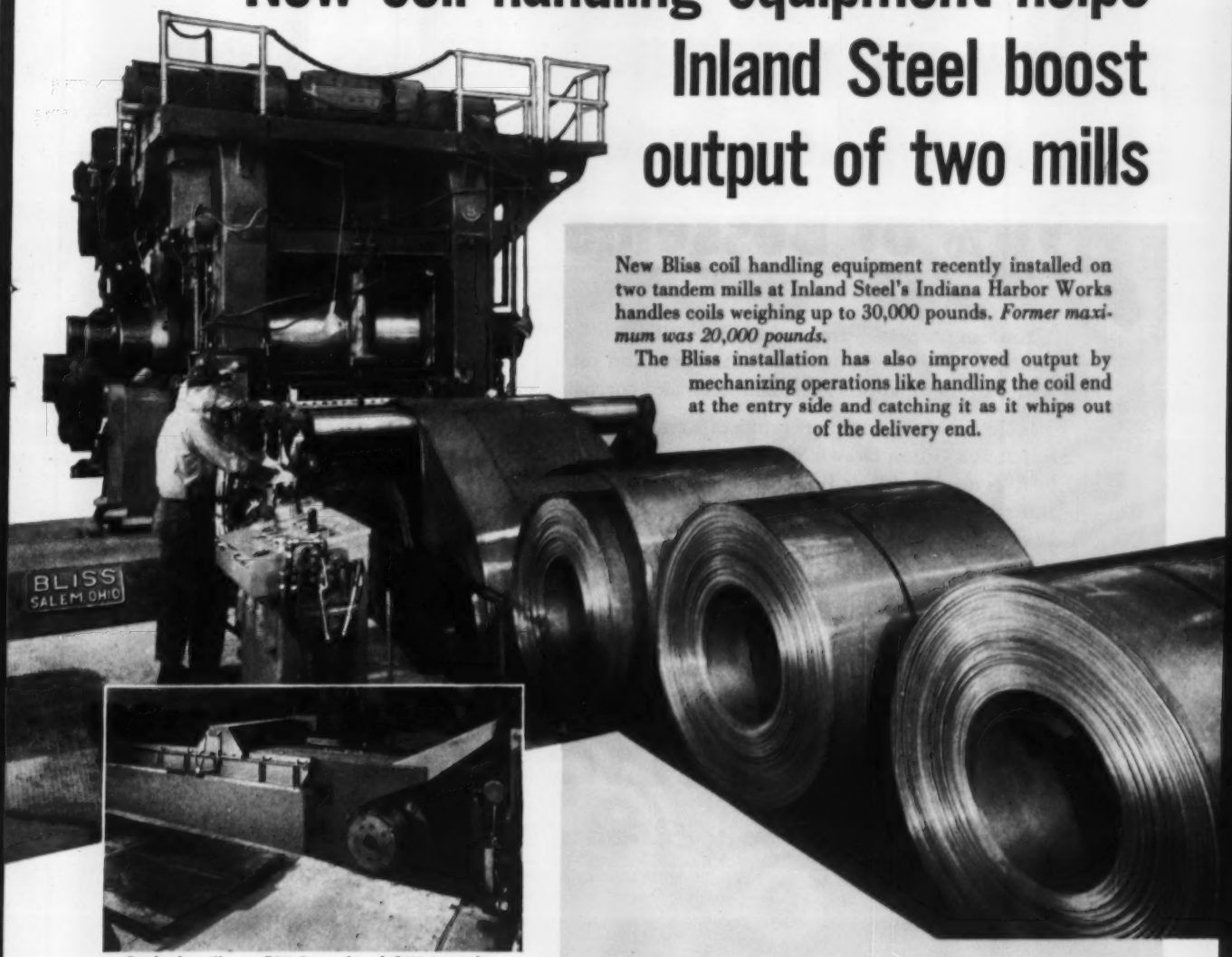
Our treatise on pickling and the use of Rodine, "Efficient Pickling with Rodine," gives full information. Send for your copy today—it makes profitable reading.

AMERICAN CHEMICAL PAINT COMPANY
Ambler 19, Pa.

DETROIT, MICHIGAN • NILES, CALIFORNIA
WINDSOR, ONTARIO

CHEMICALS ACP PROCESSES

New coil handling equipment helps Inland Steel boost output of two mills



New Bliss coil handling equipment recently installed on two tandem mills at Inland Steel's Indiana Harbor Works handles coils weighing up to 30,000 pounds. *Former maximum was 20,000 pounds.*

The Bliss installation has also improved output by mechanizing operations like handling the coil end at the entry side and catching it as it whips out of the delivery end.

On both mills—a 72″ 3-stand and 54″ 4-stand—Bliss reel and horizontal belt wrappers like the one above, provide tight, smooth-edged coils.

Bliss entry equipment on 72″ mill handles 30,000-lb. coils, mechanically sticking ends.

This mechanization of steps that used to be heavy and hazardous manual labor has meant greater tonnage per man and improved operator safety.

Inland Steel's experience with these two mills shows how safety improvement and production increases can often be coaxed from existing mill equipment simply by improved methods of handling.

It's likely that you too can crack a hidden bottleneck by consulting Bliss. For information on the Bliss line and what it can do for you, write for your free copy of our 60-page Rolling Mill Brochure, Catalog 40-A.

BLISS
SINCE 1857

is more than a name...it's a guarantee

E. W. BLISS Company, Rolling Mill Division: Salem, Ohio

Plants in Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; Midland and Pittsburgh, Pennsylvania; San Jose, California — E. W. Bliss (England) Ltd., Derby — E. W. Bliss Co. (Paris), France

You can machine Stainless Steel parts like these at rates up to 90% of Bessemer screw stock

You can do it with free-machining ENDURO Stainless Steel Bars. They'll machine beautifully at every station on your automatics. And you'll be giving your duplicate steel parts the added strength, appearance, and heat- and corrosion-resistant qualities of stainless steel.

Included in the complete range of stainless steel analyses supplied in cold finished form by Republic's Union Drawn Steel Division are two grades, A.I.S.I. 416 and 430-F, that are fully 90% as machinable as Bessemer screw stock. Add to this machinability the close tolerance, accuracy of section, uniform soundness and fine surface finish provided by cold drawing.

All these qualities combine to help you produce fine-quality stainless steel parts at highest production rates and at lowest unit costs.

In addition to cold finished bars, Republic ENDURO Stainless Steel is available in hot rolled bars, special sections and wire. Republic metallurgists and engineers will give you expert, obligation-free assistance on applications, processing and use. Just mail the coupon for more information.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
3120 East 45th Street
Cleveland 27, Ohio

Please send me more information on:

☐ Free-Machining ENDURO® ☐ Titanium

☐ ELECTRUNITE® Mechanical Tubing ☐ "Nylok" Nuts

Name_____ Title_____

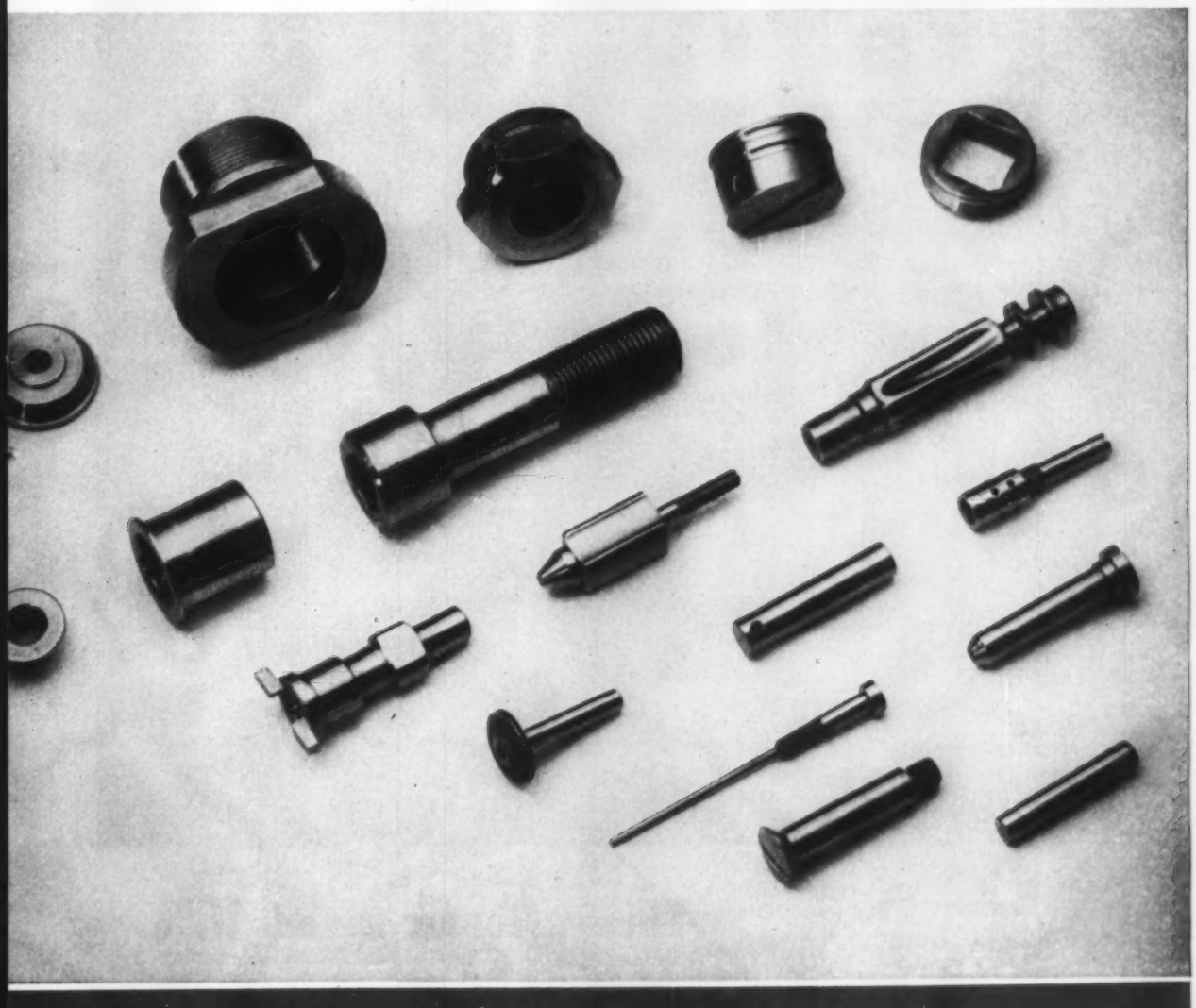
Company_____

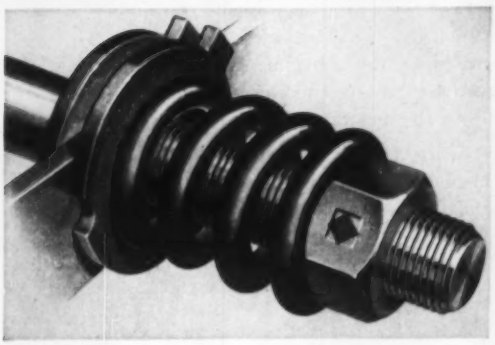
Address_____

City_____ Zone____ State_____

K-8078

YOU CAN MASTER PROBLEMS LIKE THIS with ELECTRUNITE Mechanical Tubing. Interior scratches, not detected before assembly, wore out the hydraulic fluid seals in a hurry in the hydraulic cylinder of the Farmhand Hi-Lift Loader. Farmhand discussed the problem with Republic's Steel and Tubes Division. The solution — a switch to special smooth ELECTRUNITE Tubing. The result — lower production costs; fewer rejects; consistently uniform inside surface finish; longer life for the seal. ELECTRUNITE Mechanical Tubing is available in carbon and stainless analyses.





YOU CAN BE SURE THAT THIS NUT WILL STAY TIGHT wherever you stop wrenching. It's Republic's "Nylok" Nut. A nylon plug in the side forces the nut tight against the opposite threads as the nut is turned on. It can be assembled from either end, manually or mechanically fed. Can be locked in any position. Photo shows positive adjustment of spring compression.

YOU CAN MACHINE TITANIUM PARTS like parts made from many other metals. This part is being hogged out of a titanium forging. It will then be turned, drilled, reamed, ground, tapped and threaded. Republic metallurgists recommend metals without prejudice. They will tell you whether titanium can be adapted to your product—will help you use it to advantage. Republic produces titanium and titanium alloys in hot and cold rolled bars, sheets, plates and billets.

This customer saved 46% in freight charges

on these stainless steel plates

THESE STAINLESS sketch plates, produced by G. O. Carlson, Inc., saved the customer 46% in shipping costs. If he had bought rectangular plates and done his own cutting, he would have paid freight on excess material which he could not use.

Then too, cutting and machining facilities were quite limited at the job site. Time and money were saved by having Carlson cut and machine the plates to the accurate tolerances specified.

For your next work involving stainless steel plates, heads and other stainless products, let us show you how—*and how much*—you save by buying from G. O. Carlson, Inc.

Stainless Steels Exclusively

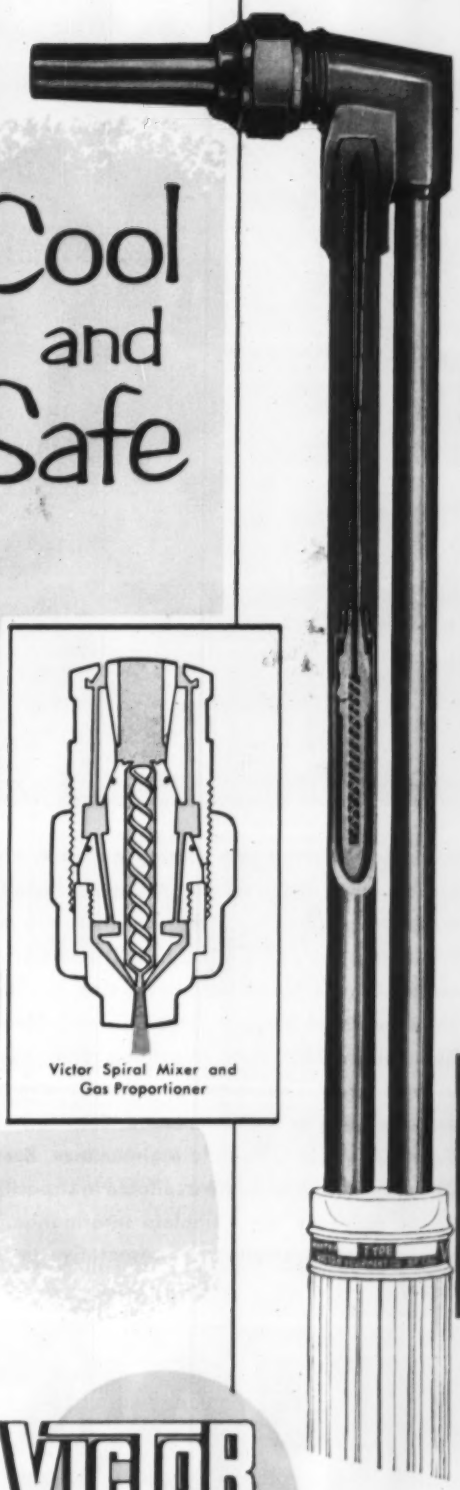
G. O. CARLSON, INC.

Plates · Plate Products · Forgings · Bars · Sheets (No. 1 Finish)

THORNDALE, PENNSYLVANIA

District Sales Offices in Principal Cities

Cool and Safe



on the HOTTEST, TOUGHEST Cutting jobs...

VICTOR

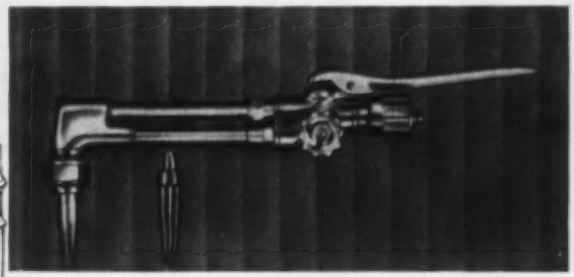
CUTTING TORCHES*

* **With stainless steel head and tube assemblies.**
* **Time-tested spiral mixers**

NOW all Victor torches and cutting attachments have rugged, stainless steel head and tube assemblies, plus time-tested spiral mixers to give you cool, safe cutting on your toughest, hottest cutting jobs. Stainless steel assembly absorbs heat slowly, withstands roughest use, is easier to maintain. Famous Victor spiral gas mixer prevents flashback and back fire, thoroughly mixes gases to make your gas dollars go further. Head and tube assembly is one unit, and can be replaced without buying a complete torch.

Test the Victor cutting torch on your most demanding, severest cutting job. See for yourself how cool it stays, how fast it cuts. Your Victor dealer will gladly demonstrate it. See him *today*.

Victor Spiral Mixer and Gas Proportioner



Cutting attachment, and cut-away of a typical Victor tip, showing carefully proportioned orifices. For best results, always use Victor tips with Victor torches.

VICTOR for welding

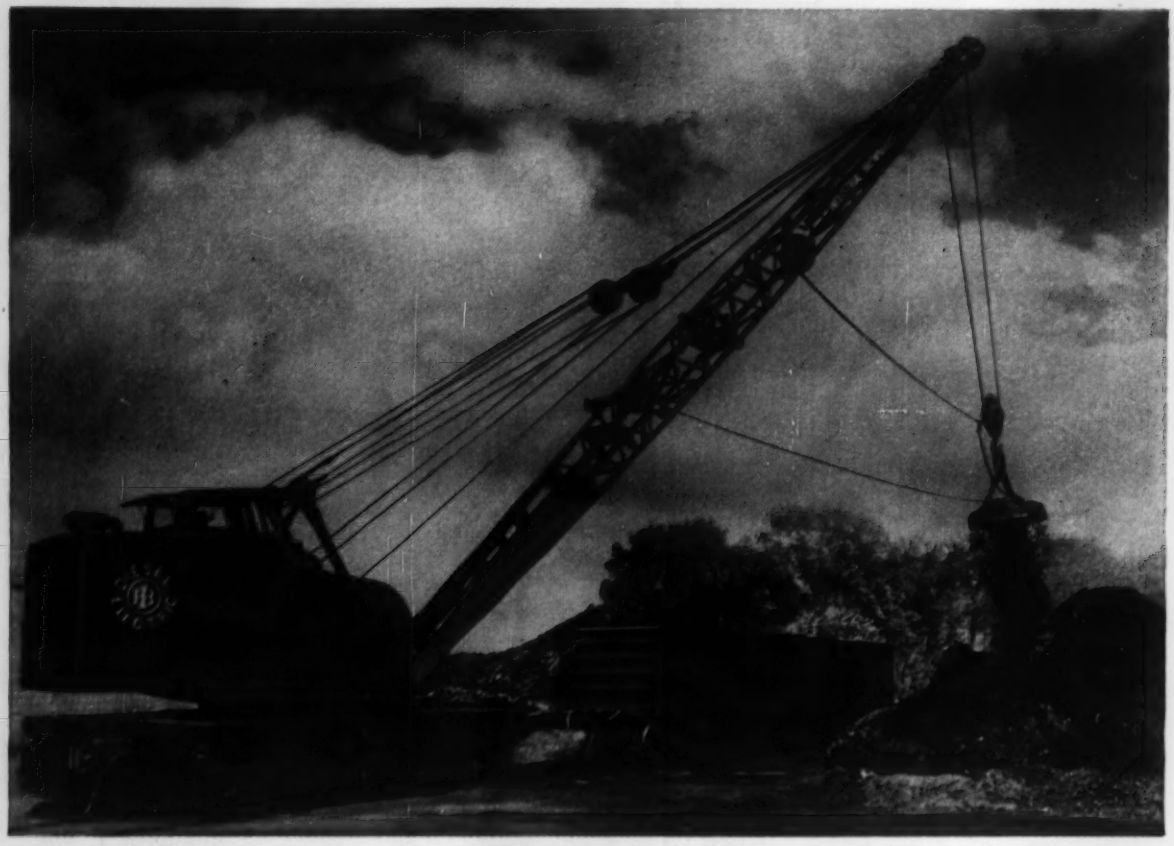
VICTOR EQUIPMENT COMPANY

Mfrs. of welding & cutting equipment; hardfacing rods, blasting nozzles; cobalt & tungsten castings; straightline and shape cutting machines.

25

844 Folsom St.
San Francisco 7

3821 Santa Fe Avenue
Los Angeles 58



With magnet hook or bucket... BROWNHOIST speeds the job

Brownhoist Cranes are helping maintain high production schedules in mines, steel mills, factories, and scrap yards . . . in fact, wherever there are railroads throughout the world. Brownhoist Diesel-Electric Locomotive-Cranes, for all their husky size, handle easily. Their patented Monitor Type Cab and Clear-Vision Boom give a 360° view. Operating controls are within easy reach. Electric travel permits operation as a switch engine as well as a crane. Constructed to last for many years with little maintenance. Brownhoist Diesel-Electric Cranes are available in capacities from 25 to 100 tons. For complete information, consult your nearest Brownhoist representative or write us today.

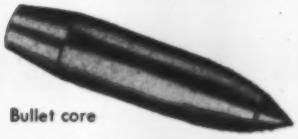
181

BROWNHOIST

BROWNHOIST MATERIALS HANDLING EQUIPMENT GIVES A LIFT TO AMERICAN INDUSTRY

SUBSIDIARY OF Penn-Texas

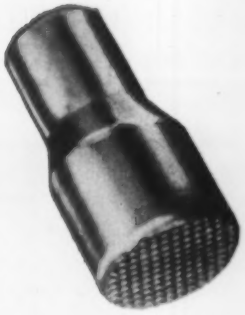
INDUSTRIAL BROWNHOIST CORPORATION
BAY CITY, MICHIGAN DISTRICT OFFICES: New York, Washington, Pittsburgh, Cleveland, Chicago, Denver, San Francisco, Montreal • AGENCIES: Detroit, Birmingham, Houston



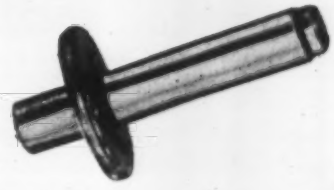
Bullet core

Cold steel flows like putty... with Pennsalt's FOS PROCESS

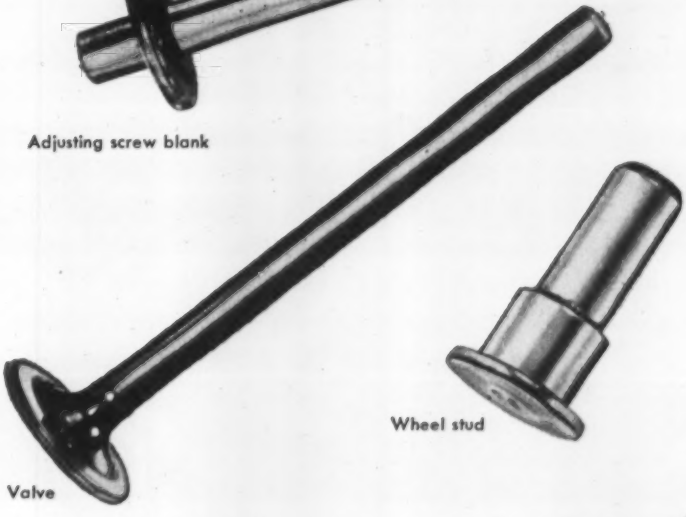
(SAVES TIME • METAL • LABOR)



Cap nut blank



Adjusting screw blank



Wheel stud

Valve

Cold extrusion is made practical, cold working of steel is more profitable with Pennsalt's Fos Process, a new method of locking a phosphate coating and lubricant onto a steel surface. Cold steel actually flows like putty when extreme pressures are applied. With Fos Process there is no breakdown of lubricants to cause seizing and galling. Die life increases . . . in one case by 666%!

Where can you use the Fos Process? In mass production of steel automotive and ordnance parts, in tube and wire drawing. Expensive steel alloys can often be replaced with plain carbon steels. The combination of Fos Process and severe cold working upgrades the physical and metallurgical properties of the steel . . . cuts unit costs!

Look at these few parts carefully. Many more parts and shapes like these can be cold-extruded or cold-headed economically, with little finish machining, by using Pennsalt's new Fos Process. Call the specialist from Pennsalt for a complete survey of your production line. Often your blueprint can help him determine rapidly if the Fos Process is for your immediate use. Fill in the coupon . . . get all the facts now!

Pennsalt Chemicals

Metal Processing Dept.
Pennsylvania Salt Manufacturing Company
Three Penn Center Plaza, Phila. 2, Pa.

- ☐ Have Pennsalt specialist call.
- ☐ Send technical illustrated folder.
- ☐ Enclosed is blueprint . . . can I use Fos Process in mass-producing by cold extrusion?

Name..... Title.....

Company.....

Address.....

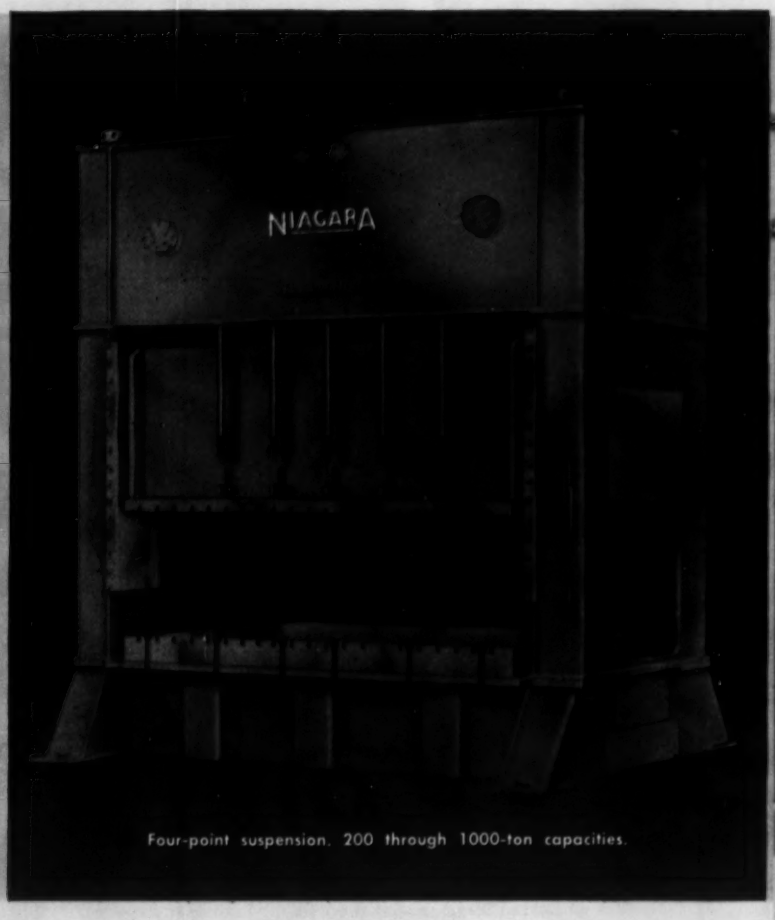
City..... Zone.... State.....

SEE US AT BOOTH 1272 — METAL SHOW — PHILADELPHIA

NEW! MASTERFULLY ENGINEERED

excels in large, heavy tonnage

One-point suspension. 100 through 1000-ton capacities.



Four-point suspension. 200 through 1000-ton capacities.

ECCENTRIC DRIVE DELIVERS GREATER TORQUE WITH LESS DEFLECTION

In Niagara Series SE Presses, the eccentric is an integral part of the main gear (or gears) which rotates on a stationary pin rigidly supported in the crown, close to the point at which the pressure is exerted. Serving merely as a pivot, the pin carries no torsional load and relatively little bending load. Net result: Niagara's eccentric gear design can deliver greater torque with less deflection than other types of construction.

RUGGED, RIGID, ALL-STEEL FRAMES PROVIDE GREATER ACCURACY, LONGER DIE LIFE

Frames are rugged, all-steel, four-piece, tie-rod construction of great strength and rigidity, stress relieved in a furnace and thoroughly grit-blasted before machining. Each frame size has been scientifically tested for deflection to meet Niagara standards — the most exacting in the industry.

LOW INERTIA, PNEUMATIC FRICTION CLUTCH RUNS COOLER, WEARS LONGER

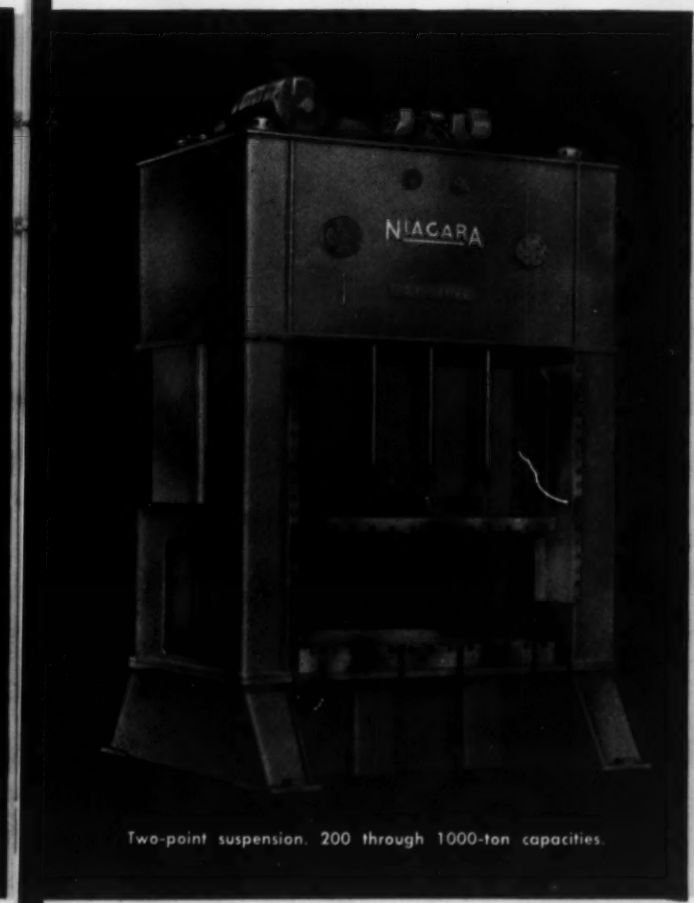
Most of the weight of the Niagara clutch continues to rotate with the flywheel. Only the drive shaft and driving plate start and stop with each cycle. The resulting low weight and inertia of the parts, picked up during clutch engagement, greatly reduce heat and wear. As the clutch rotates, it acts as a centrifugal blower, providing positive ventilation. Plates automatically compensate for normal wear, with no adjustment necessary.

MODERN, STREAMLINED DESIGN EMPHASIZES COMPACTNESS

The entire driving assembly is neatly housed in the crown. There is no exposed, overhanging flywheel, clutch, brake, shaft nor motor in the rear of the press to obstruct crane service, block light, throw grease or consume space unnecessarily.

LINE OF METALWORKING CHAMPIONS

drawing, punching and blanking work



Two-point suspension. 200 through 1000-ton capacities.

Without equal in engineering design, performance and stamina, this great new line of Niagara Straight Side Eccentric Geared Presses is every inch a champion. It is an outstanding example of the advanced thinking that has made Niagara the pace-setter among builders of metal working machines for 75 years.

Masterfully engineered and ruggedly constructed to handle a tremendous variety of work, the new Niagara SE Series is the most practical and dependable press line built for:

- Work requiring large die areas.
- Heavy tonnage demands.
- Long stroke, deep drawing jobs where work is engaged high up on the stroke.
- Bottom-of-stroke blanking and punching.

THE COMPLETE STORY IS READY FOR YOU NOW!

Make a feature-by-feature appraisal of what these great new presses can do for you. Write for newly published, illustrated Bulletin 66. It will be forwarded promptly without obligation.

NIAGARA MACHINE & TOOL WORKS • BUFFALO, 11, N.Y.

DISTRICT OFFICES: BUFFALO • CLEVELAND • DETROIT • NEW YORK PHILADELPHIA

Dealers in principal U. S. cities and major foreign countries.

DELUXE OPERATING CONTROLS INSURE UTMOST SAFETY, EFFICIENCY AND CONVENIENCE

Compactly and conveniently arranged on a master panel, Niagara controls are instantly accessible for fingertip direction of every press operation: starting, slide adjusting, jogging, die tryouts, running and stopping. The latest safety devices provide maximum protection for die setter, operator and the press itself. Nothing has been overlooked. Trial runs assure that all controls are in proper working order before each Niagara press leaves the plant.

NIAGARA

STRAIGHT SIDE ECCENTRIC GEARED PRESSES

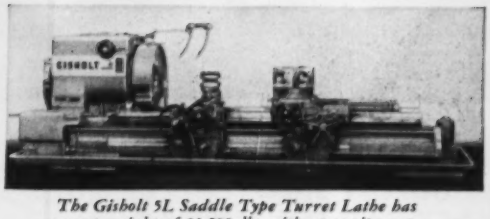
America's Most Complete Line of Presses, Shears, Machines and Tools for Plate and Sheet Metal Work

"Here's why GISHOLT insists upon the HEAVIEST CASTINGS!"

Look at them . . . castings for the heaviest saddle type turret lathes in the business! Look at all the angles:

First, note how the headstock is cast integrally with the bed for perfect spindle alignment . . . how cross supports give the most solid base for carriages, tools and slides . . . how extra-heavy webbing gives the headstock the ruggedness to support powerful gear train members.

Remember, too, that cast iron absorbs vibration. The heavier the better! And Gisholt controls the quality of the finest nickel semi-steel in its own foundry.



The Gisholt 5L Saddle Type Turret Lathe has a net weight of 22,500 lb. without equipment.

What does it mean to you? You can load up your Gisholts with carbides and really turn out the chips! You've got the strength, the rigidity and the freedom from vibration to take all the speed you can get from today's carbides—with the heaviest feeds—and still have the safety margin to take care of tomorrow's tool bit developments.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

TURRET LATHES · AUTOMATIC LATHES · SUPERFINISHERS · BALANCERS · SPECIAL MACHINES

Every 3 seconds—a heated bar with this Magnethermic 10,000 cycle Induction Heater

This 10,000 cycle unit preheats 1" steel bars to 2300 degrees for upsetting at rate of one every 3 seconds or over 1,000 per hour.

Induction preheating for forging or extrusion has many advantages: speed, economy, cleanliness, close control, adaptability, increased die life and attractive working conditions.

But the question of which frequency—low, dual or high, sometimes confuses the issue. Each has its own place and its advantages.

Magnethermic makes induction heaters only, 60 through 10,000 cycles, and can give you experienced guidance on selecting the best frequency for your heating job.

Low—Dual—High Frequency?

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INDUCTION HEATING

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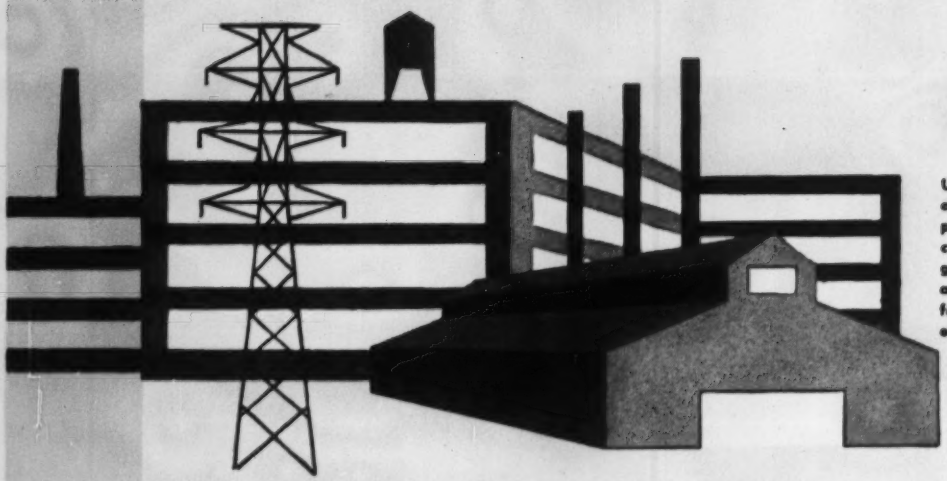
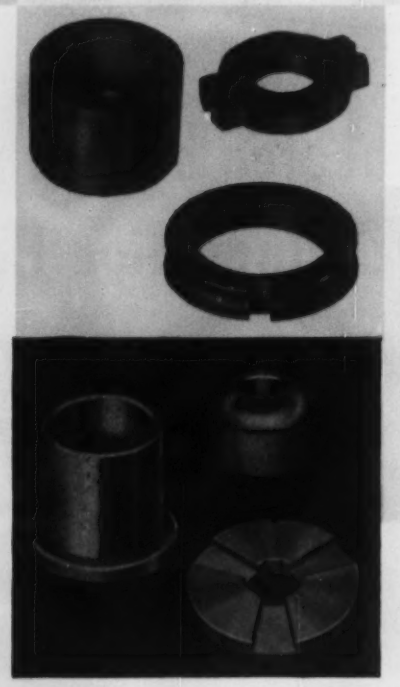
3990 SIMON ROAD . YOUNGSTOWN 7, OHIO

60 THROUGH 10,000 CYCLES

PRODUCTS that are improving the efficiency and speeding production in American industry



USG® Brushes are available in production or replacement lots in carbon, carbon-graphite, electrographitic, pure graphite and metalgraphite grades for all types of rotating electrical equipment.



GRAPHITAR® (carbon-graphite) is a versatile engineering material of carbon-graphite composition offered in many grades for bearings, seals, piston rings, pump vanes, thrust washers, valve seats, pistons, bushings.

Metallurgical graphite grades for carbon control in iron and steel melting, mold coatings, hot topping compounds, Cordip®, Mexaloy® for refractory mixtures and other MEXICAN® products.

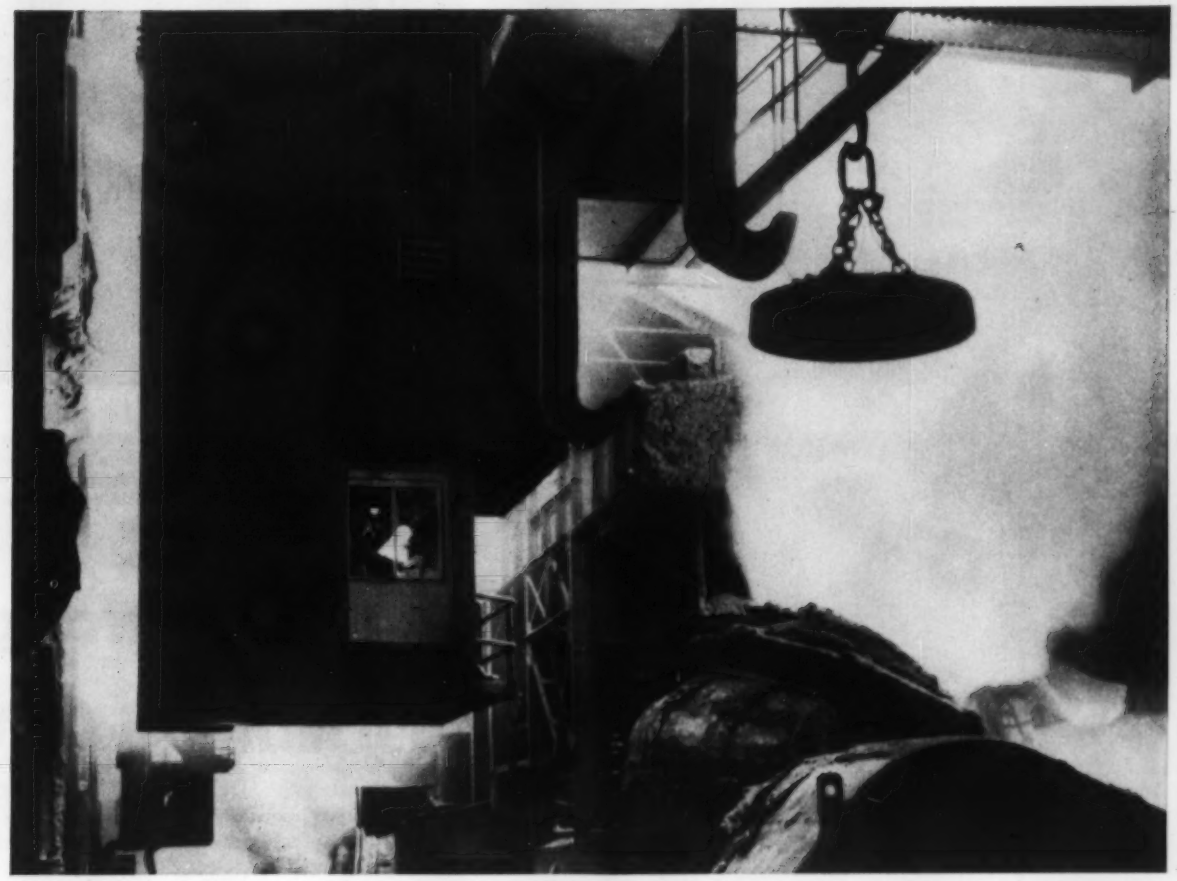
206

GRAMIX®: Sintered-metal bearings, gears, cams, slides, rollers, bushings and machine parts available in ferrous and non-ferrous alloys. The metal with the built-in lubrication.

OUR 101ST YEAR

THE UNITED STATES GRAPHITE COMPANY

DIVISION OF THE WICKES CORPORATION • SAGINAW, MICHIGAN



SOLVED... one of the toughest crane operating problems in the steel industry

When 3000° Bessemer converters blow into action, crane area temperatures soar to 200°F and are accompanied by blowing iron-graphite particles and fumes. These conditions make this one of the roughest crane operating spots in steel-making. To maintain work schedules most mill operators have to provide plenty of periodic heat relief for the cranemen. But, at best, this is only a costly stop-gap measure as heat still builds up rapidly in the cab causing operator efficiency lag with its attendant safety hazard.

Only recently Jones & Laughlin Steel Corporation put in operation at their Aliquippa Works a new crane that holds the solution to this problem. For this application Dravo engineers designed and built a special 10 hp conditioning unit that will cope with these extremes—conventional standard model crane cab conditioners couldn't provide sufficient capacity. Now, crane operation can be maintained in a comfortable cab of 80°-85°F without costly interruptions for relief or rest. Air entering the cab is also freed from irritable particles and fumes through the use of mechanical and activated carbon filters. The unit provides complete year-around conditioning so that heat is provided in wintertime to maintain a 70°F cab temperature.

In addition to this special unit, standard model 5 and 7½ hp Dravo Crane Cab Conditioning units have cut to *zero* work stoppages once necessary to cool the cabs over their open hearth, soaking pit and hot slab handling areas. Perhaps you have a similar crane operating problem where Dravo Crane Cab Conditioners could offer a solution. Use the coupon for complete information.

Dravo Corporation, Department B-1110
Fifth and Liberty Avenues
Pittsburgh 22, Penna.

☐ Please send Bulletin 1301A "Crane Cab Conditioners."

☐ Please have a representative call at no obligation to me.

DRAVO
CORPORATION
Pittsburgh 22, Pennsylvania

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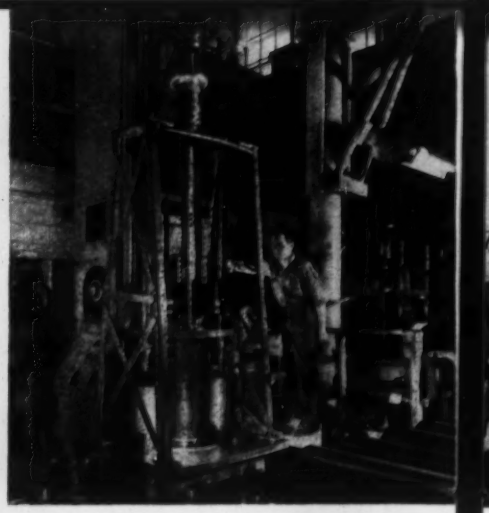
1. Welding The Main—Fittings and base plate are welded into the base of an oil hydraulic cylinder. The steel tubing must make a sound weld without warping.

2. Machining The Main—High speed threader (235 rpm) cuts close tolerance threads on the inside diameter for bronze packing nut and steel stop ring. Snug fit is essential to add strength to cylinder and prevent leakage under pressure.

3. Turning The Sleeve—The outside diameter of the sleeve is turned, and then ground to even finer finish. Straightness and concentricity in the tubing is most important. Proper stress-relief annealing of the steel prevents warping.



4. Honing The Sleeve—On this vertical honing machine, the inside of the sleeve (center) is finished to a 16 microinch finish for piston-ring fit to contain the hydraulic pressure when cylinder is operating.

How Strong Get

Strong, powerful arms of steel in the form of oil hydraulic cylinders are being used increasingly on industrial equipment, machinery, tractors, earth movers, loaders, lift trucks, portable drilling rigs. They transmit power smoothly, economically.

Among the producers of oil hydraulic cylinders, one of the largest and best known is the Commercial Shearing and Stamping Company of Youngstown, Ohio.

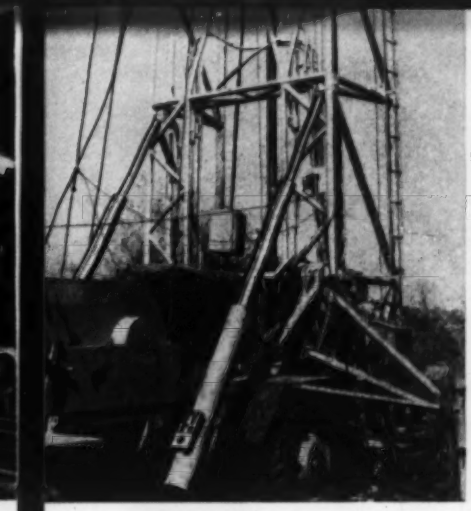
Take a look at the way Commercial produces just one of its many models: the two-sleeve telescopic cylinder used to erect the boom of a portable rotary drilling rig.

Each rig is equipped with two of these cylinders. They have a stroke of nearly 10 feet, providing an initial thrust of 35 tons. This lifts the boom from a horizontal folded position to a vertical extended position. To reverse the operation, the cylinder's double acting feature develops a thrust of nearly 20 tons on the pull stroke.

The tubular parts of each cylinder consist of a main, a sleeve, and a plunger. As the cylinder operates under oil hydraulic pressure up to 1,000 psi, the main provides the base for actuating the sleeve and plunger.

In production, these tubular parts are turned, ground and honed. Fit-

(Advertisement)



5. Raising A Rig—The double acting cylinders on this portable Franks rotary drilling rig provide one example of the many models of oil hydraulic cylinders produced by Commercial.

6. 100-Per-Cent Inspection—Every cylinder made at Commercial is tested on equipment that develops the full pressure loads that are required under field operating conditions, and is thoroughly inspected during operation.

Arms of Industry Their Muscles

tings are welded into position. Ends are threaded to hold packing nuts and stop rings. From start to finish, all operations require detailed scientific accuracy (see photos).

• **What It Takes**—You can readily see why the steel tubes for each cylinder must have special properties for this specific application.

Each tube must have uniform close dimensional accuracy, straightness, and concentricity, so that the amount of steel removed in turning, grinding and honing can be kept to a minimum. Extra time on these operations is expensive.

The steel must have machinability. It can't be too soft or too hard. It must be clean in its chemical composition and clean on the surface. At the same time it has to weld easily. And it must take both machining and welding without warping. Finally, it must have extra strength for the variety of stresses that the load of raising, holding, and lowering the rotary drilling rig boom will place on it in field operations.

The mechanical seamless tubing supplied by Pittsburgh Steel for this cylinder ranges in size from 7.210 inches inside diameter with a wall thickness of .395 inch for the main, down to 3.250 inches inside diameter with a wall thickness of .313 inch for the plunger. It is a low carbon steel of inherent quality, cold drawn to exact uniform size for easy machining and honing. It is stress-relief annealed to prevent warpage during manufacture. And it provides a tensile strength of over 60,000 psi.

• **What This Means To You**—Commercial uses Pittsburgh Steel's seamless mechanical tubing for this and many other types of cylinders because it can rely on excellent performance in production and high quality in the finished product.

If you have an application for seamless tubing, why not look into the opportunities Pittsburgh Steel can offer you?

Pittsburgh Seamless Mechanical Tubing is also available from:

Baker Steel & Tube Company
Los Angeles, California

Chicago Tube & Iron Company
Chicago, Illinois

The Cleveland Tool & Supply Co.
Cleveland, Ohio

Drummond McCall & Co., Limited
Montreal, Quebec, Canada

Edgcomb Steel Company
Philadelphia, Pennsylvania

Gilmore Steel & Supply Co.
San Francisco, California

Earle M. Jorgensen Co.

Mapes & Sprowl Steel Co.
Union, New Jersey

Metal Goods Corporation
St. Louis, Missouri

Miller Steel Company, Inc.
Hillside, New Jersey

A. B. Murray Co., Inc.
Elizabeth, New Jersey

C. A. Russell, Inc.
Houston, Texas

Ryerson, Joseph T. & Son, Inc.
Chicago, Illinois

Solar Steel Corporation
Cleveland, Ohio

Steel Sales Corporation
Chicago, Illinois

Tubular Sales
Detroit, Michigan

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(Advertisement)

MICROHONING . . . FACTS YOU SHOULD KNOW

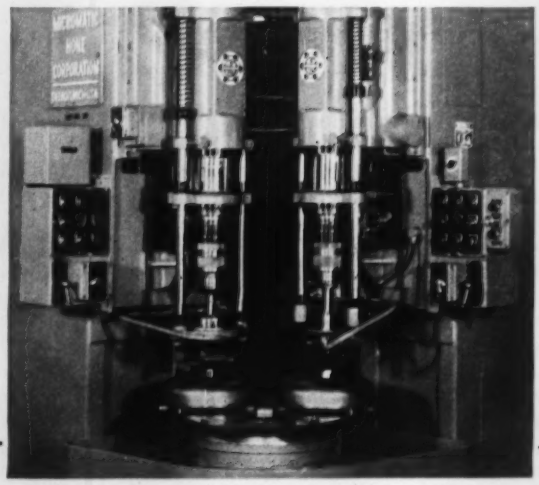
Compare These Microhoning Advantages

- Rapid and efficient stock removal.
- Dimensional accuracy obtained in every part.
- Macrogeometric accuracy—the Microhoning action is not affected by vibration; long abrasive stones generate a true surface.
- Microgeometric accuracy—any desired surface finish and cross-hatch angle duplicated in every part.
- No concentration of heat—the structural surface of the part is undamaged.
- Microhoning applications include tapers, spheres, splines, tandem or interrupted bores, flat surfaces, and any type of material, regardless of hardness (or softness).
- No practical limitation on part length and diameter.
- No chip removal problem—the minute Microhoning chips are flushed away in the coolant and automatically removed.
- Automatic size control.
- Readily adapted to automation.
- Eliminates tool dressing time and cost.
- Location of bores is undisturbed.
- Float principle and low speeds assure minimum maintenance.
- Backed by over 26 years of engineering and service experience.

PRECISION PRODUCTION THROUGH MICROHONING — MICRO MATIC — TRADE MARK

Microhoning is a low-velocity abrading process that employs thousands of small cutting tips. Because simultaneous and continuous cutting action of tips is spread over a wide area, stock is rapidly removed with a minimum of heating. This abrading technique generates functional surfaces ***by obtaining in one operation the required tolerances, specifications, or condition*** of the surface characteristics.

Included in these characteristics are: dimensional size (the distance between points or faces of a part, e.g., the diameter of a bore); macrogeometry (waves whose crests are more than 1/32" apart); microgeometry (roughness or scratches whose crests are less than 1/32" apart); and surface structure.



Microhoning . . . Example Application

Microhoning both I.D. and O.D. of the hub of a transmission torus cover to generate geometric accuracy and a surface finish of 10 microinches.

O.D.—*2.375", approx. 1" long, blind end*
I.D. —*2.125" x .280" long*
58-60 Rockwell "C"
Stock removal: *.001" to .002"*
Surface finish: *10 microinches*
Production: *180 per hour, gross.*

***MICROHONING = Stock Removal + Geometry + Size Control + Surface Finish**

Movies describing various machining processes and the generation of functional surfaces are available for group meetings. For literature or further information on films, write to:

MICROMATIC HONE CORPORATION

8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

background of champions . . . . BRICK

The stands may be steel, the walls concrete, but there'd be no World's Series crowd like this were it not for brick, and you'd have no money to pay for a seat.

Brick—refractory brick—is the fundamental and universal material of industry. It stands at the beginning of manufacturing, power, transportation . . . everything that's made or moved.

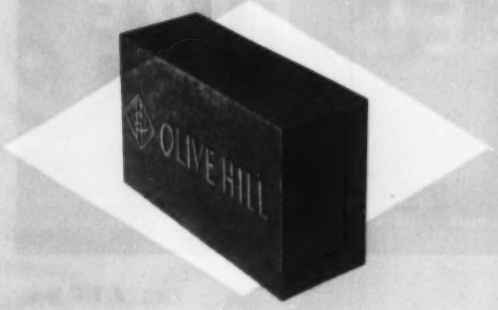
Meeting these needs, with the infinite variety of their requirements, calls for massive production facilities. But even more important, it calls for the application of the most advanced and intricate physical sciences.

The first we provide with plants located from coast to coast. The latter with the world's largest and most modern refractories research laboratory.

GENERAL REFRACTORIES COMPANY
Philadelphia 2

A COMPLETE REFRACTORIES SERVICE FOR THE STEEL INDUSTRY

OLIVE HILL BF and OLIVE HILL HI-FIRED brick rank high in any list of prominent and widely used brands of blast furnace refractories. Manufactured from dense-burning Kentucky flint fire clays by Grefco's unique manufacturing processes, OLIVE HILL brick set a standard for blast furnace refractory quality and workmanship.

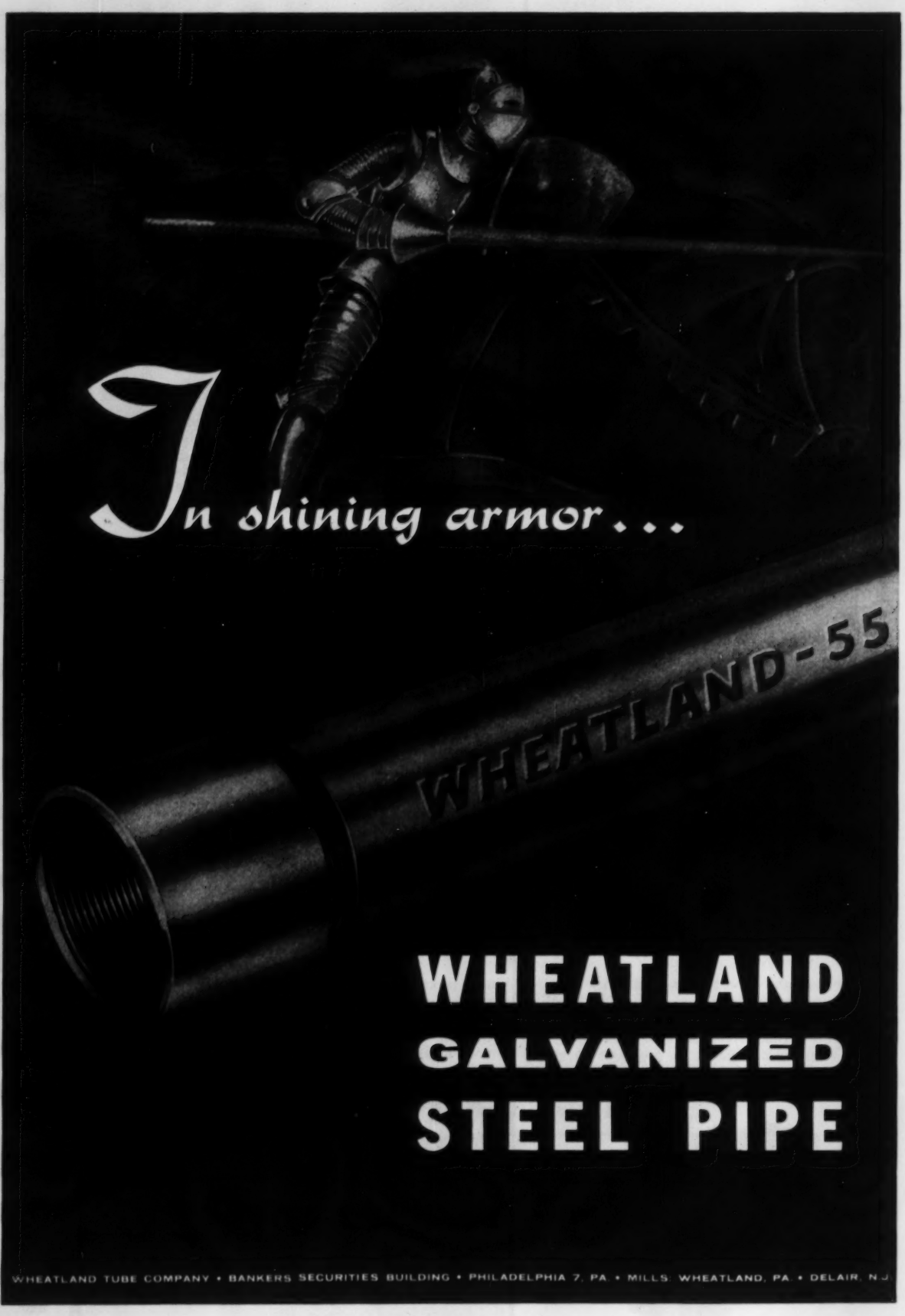


Grefco processing of OLIVE HILL brick entails:

1. Careful selection, testing, stockpiling and blending of fire clays to insure uniform raw material quality.
2. Grinding and screening to prescribed formula to promote high density of product.
3. Efficient deairing during brick forming, also to promote density and proper physical structure.
4. Careful firing to exacting temperature schedules to yield uniform high quality brick.
5. Close inspection of final product with gauging and sorting of brick to close size tolerance.
6. Quality control by statistical analysis procedures for the manufacturing processes.

In service, OLIVE HILL blast furnace brick, both BF and HI-FIRED, have produced many splendid performance records in the past. OLIVE HILL linings in presently operating furnaces, are giving outstanding performance and are more than meeting the increasing requirements of the expanding American Iron and Steel Industry.

GENERAL REFRACTORIES


In shining armor...
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STEEL PIPE
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Whatever the job...

PERMACEL 32
PLASTIC TAPE

marking or masking

PERMACEL 77
MASKING TAPE

SELF-STICKING

PERMACEL® TAPES

In our complete line, there's a self-sticking tape for every job . . . write Permacel Tape Corporation, New Brunswick, N. J.

a Johnson & Johnson company

Complex shapes– Better alloys at lower cost with investment casting

Complete Design Freedom can be yours with investment casting. Ferrous and non-ferrous alloys including magnesium are cast with great detail, intricacy of shape and to close dimensions. Substantial Reductions in Production Costs are possible by reducing machining operations to the minimum.

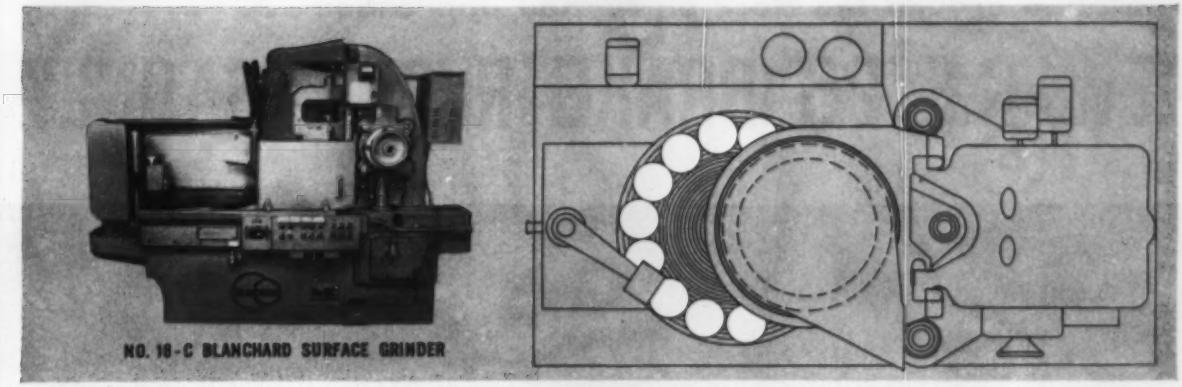
- Assembly costs are cut by combining two or more components into an integral casting
- Large and small quantity production (including prototypes) are cast economically
- Tooling costs are relatively low

Arwood's four plants have complete tooling facilities and government approved inspection equipment.

If you use metal in your business investigate the possibilities of investment casting . . . send for literature or call for consultation. We welcome parts or prints.

ARWOOD PRECISION CASTING CORP.
66 Washington St. Brooklyn, N. Y.

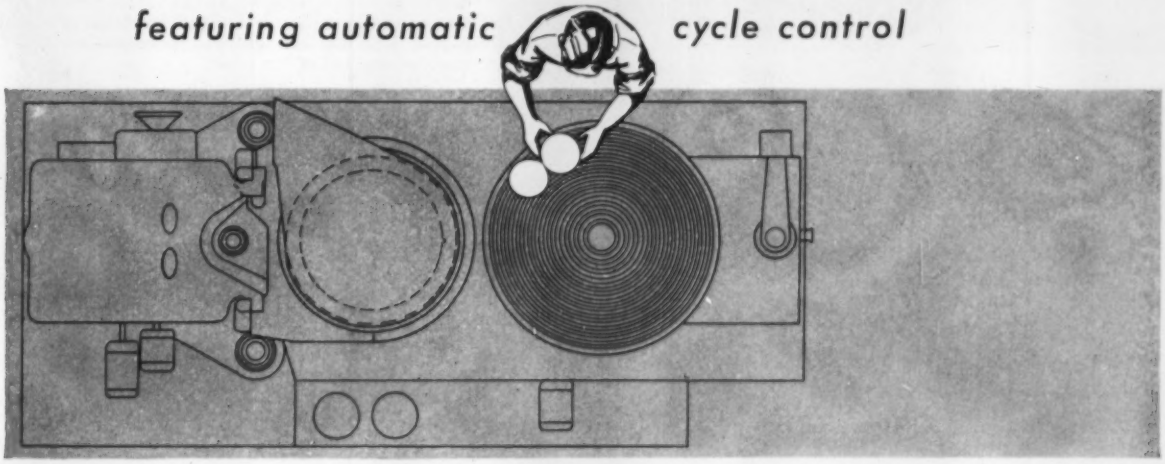
PLANTS: Brooklyn, N. Y. • Groton, Conn. • Tilton, N. H. • Los Angeles, Calif.



NO. 18-C BLANCHARD SURFACE GRINDER

Plan for more profitable production with this new Blanchard Grinder

featuring automatic cycle control



This great new Blanchard has the speed and simplicity which guarantee economical grinding on a wide variety of jobs.

One operator can easily operate two of these automatic cycling surface grinders. By using the automatic cycle, he can unload, clean and reload one grinder while the other grinds automatically.

The automatic cycle does everything else: moves chuck (30″ or 36″ dia.) to grinding position and starts it rotating; starts wheel rotation and coolant pump; provides rapid wheel approach to work; engages power down-feed at preset rate; changes to fine feed just before finished size is reached; stops feed when work is to size — "sparks" out; raises wheel head; stops wheel, coolant pump and chuck; moves chuck to loading position—demagnetizes chuck.

The No. 18-C also features: push button selection of manual or automatic operation; automatic size control; simple feed and head traverse controls; adjustable dwell timer.

This new Blanchard offers you many new production advantages. Look into them today — write for free catalog showing work done on the No. 18-C.

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY **64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.**

Operating around the clock on rugged application . . .

NEW G-E DC BRAKE REQUIRES ONLY

G-E DIRECT-CURRENT BRAKE installed on slab depiler at Jones & Laughlin. Brake has required no maintenance in first eight months of rugged duty. All settings and connections are made at one end of the brake.

GENERAL ELECTRIC

ONE ADJUSTMENT IN EIGHT MONTHS

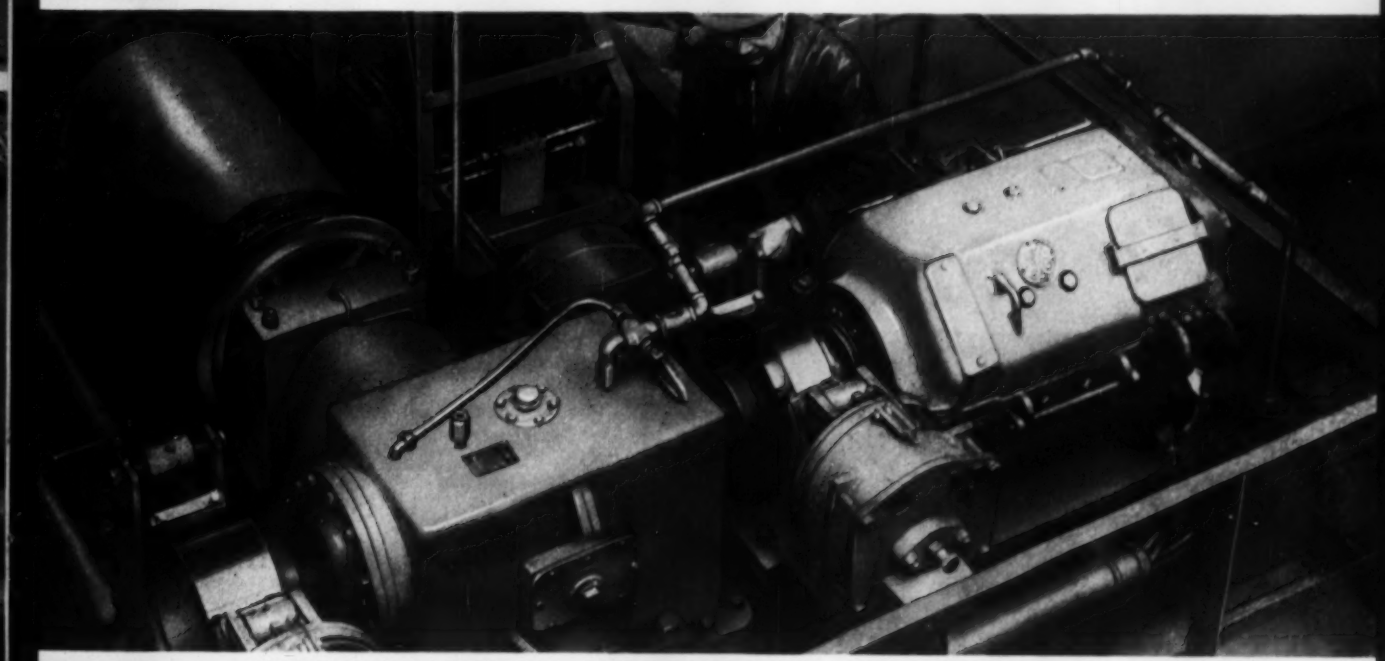
Normal compensation for lining wear at half-million operations only maintenance needed

In its first eight months of operation, a new General Electric direct-current brake has functioned with no faults and has required no maintenance or parts at Jones & Laughlin Steel Corporation, Cleveland Works Division. Only the recommended, normal adjustment for lining wear was made after half-million mark was reached. The brake is in use 24 hours a day on a slab depiling operation vital for continuous steel processing in the hot strip mill area of the plant.

Well satisfied with the brake's excellent performance, J&L specified three more General Electric DC brakes on a new 15-ton slab handling crane which recently went into service at their Cleveland Works. Rapid movement of the slabs with maximum safety for personnel are of vital importance to J&L's management and the G-E brakes are fulfilling these requirements.

The General Electric DC brake offers full-rated torque in the worn-gap position, (extra braking torque when you need it most) as well as features like single point adjustment, easily removable linings, armature-gap indicator, positive manual release, versatility of installation, and conformation to AISE Standards.

For more information about the General Electric direct-current brake contact your nearest G-E Apparatus Sales Office, or write for bulletin GEA-6214. Section 781-11, General Electric Company, Schenectady 5, New York.



SPECIFIED BECAUSE OF EXCELLENT PERFORMANCE by new G-E brake (opposite page), three G-E DC brakes were ordered by Jones & Laughlin for this 15-ton slab handling crane at the company's Cleveland Works.

Progress Is Our Most Important Product

GENERAL ELECTRIC

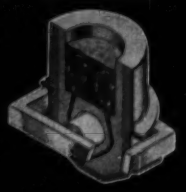
AJAX

ONE NAME...FOUR LEADERS

In Melting, Forging and Heat Treating

When it comes to heating metal, one name—and only one—has the standing of AJAX. Four AJAX associates bear this name and each has originated and developed a basically new furnace for the industry. More new industries, perhaps even your own, have developed from AJAX heating than from any other method of heating since the turn of the century. The combined experience and cooperation of all AJAX engineers justifies your confidence that an AJAX recommendation will be the best for your work.

AJAX



AJAX ELECTRIC FURNACE CORP. . . . 1911

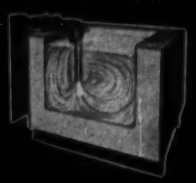
AJAX-Wyatt low frequency induction furnaces for melting or superheating cast and malleable iron, and for melting copper base and zinc alloys in the rolling mill and sand casting foundry. Write 1108 Frankford Avenue, Philadelphia 23, Pa.

AJAX

AJAX ELECTROTHERMIC CORP. . . . 1916

AJAX-Northrup high frequency induction melting and heating furnaces using motor generators or spark gap converters for ferrous and non-ferrous metals, including vacuum melting. Also forging, hardening, brazing, carburizing, sintering. Write Trenton 5, New Jersey.

AJAX



AJAX ELECTRIC COMPANY 1931

AJAX-Hultgren electric salt bath heat treating furnaces — internally heated — used for aluminizing, annealing, austempering, brazing, carburizing, cleaning, descaling, hardening, martempering, etc. Write 980 Frankford Ave., Phila. 23, Pa.

AJAX

AJAX ENGINEERING CORP. . . . 1941

AJAX-Tama-Wyatt low frequency induction furnaces for melting, holding, coating, and automatically pouring metals in die-casting, permanent mold, and sand casting foundries — particularly aluminum, zinc, brass, and bronze alloys. Write Trenton 7, New Jersey.

COUNT ON YOUR WICKWIRE ROPE DISTRIBUTOR FOR ENGINEERING ASSISTANCE

When it's a question of wire rope, the place to go is to your Wickwire Rope distributor. He knows your requirements. He knows wire rope and how it can be used to best advantage. In addition, he can provide you with this important extra—the technical assistance of Wickwire Sales Engineers. With the additional help of these capable specialists, he can give you expert, practical advice on even the toughest wire rope problems.

Your Wickwire Rope distributor is a good man to know. He's quality people handling quality products. Buy your wire rope and wire rope slings from him. You'll find that the many valuable services he offers far outweigh any apparent price advantage you might gain by buying direct.

CF&I WICKWIRE ROPE A CF&I PRODUCT

A PRODUCT OF THE COLORADO FUEL AND IRON CORPORATION

3150

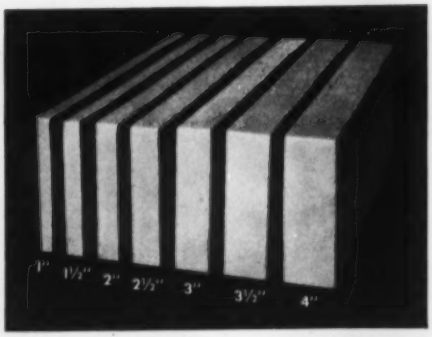
Specify J-M Superex, industry's favorite block insulation

Made from diatomaceous silica and asbestos for all temperatures to 1900F

YOU'LL ENJOY *greater insulation savings* with Superex®. Its unique combination of low conductivity and outstanding resistance to high temperatures provides greater operating efficiency and longer maintenance-free service. That's why Superex is the leading block insulation for furnace work.

Light and easy to work. Superex withstands temperatures to 1900F indefinitely with negligible loss of efficiency and is so strong that it compresses only ⅛ inch under 6 tons' pressure per square foot. Its light weight, excellent working properties and availability in large blocks mean quick, easy, low-cost installation.

For high temperature equipment. Since its introduction in 1927, Superex has received enthusiastic acceptance. Today it economically insulates 90% of the country's hot blast stoves. Other high temperature equipment where Superex has proved its superior performance include most types of industrial and metallurgical furnaces and ovens, stationary and marine boilers, regenerators, kilns, roasters, high-temperature mains, flues and stacks.



Saves waste—Superex comes in 7 standard thicknesses from 1" to 4". Other sizes available on order.

For further information on Superex, write to Johns-Manville, Box 60, New York 16, N. Y. In Canada, Port Credit, Ont.

JM PRODUCTS

Johns-Manville *first-in* INSULATION

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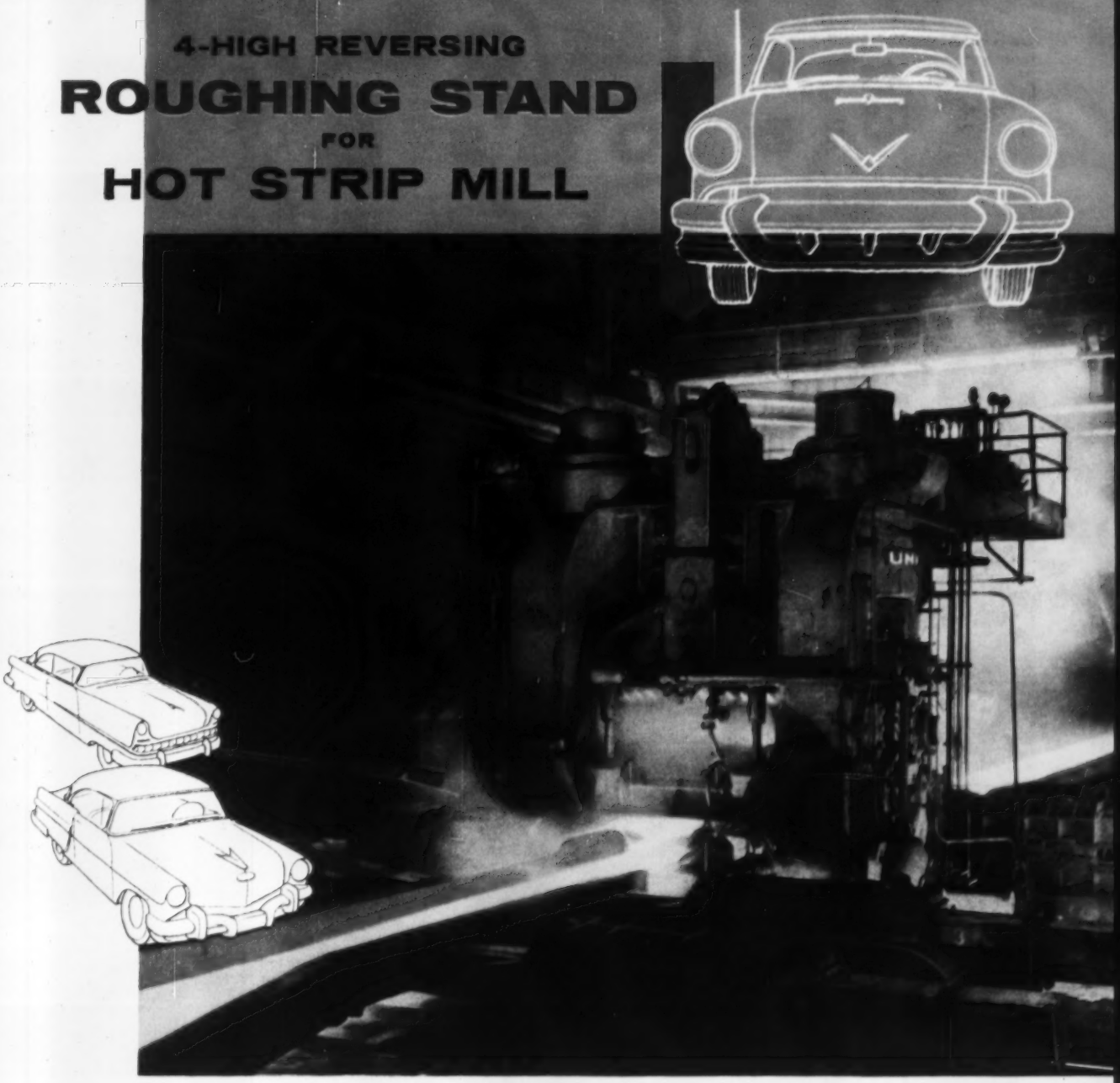
HOT STRIP MILL



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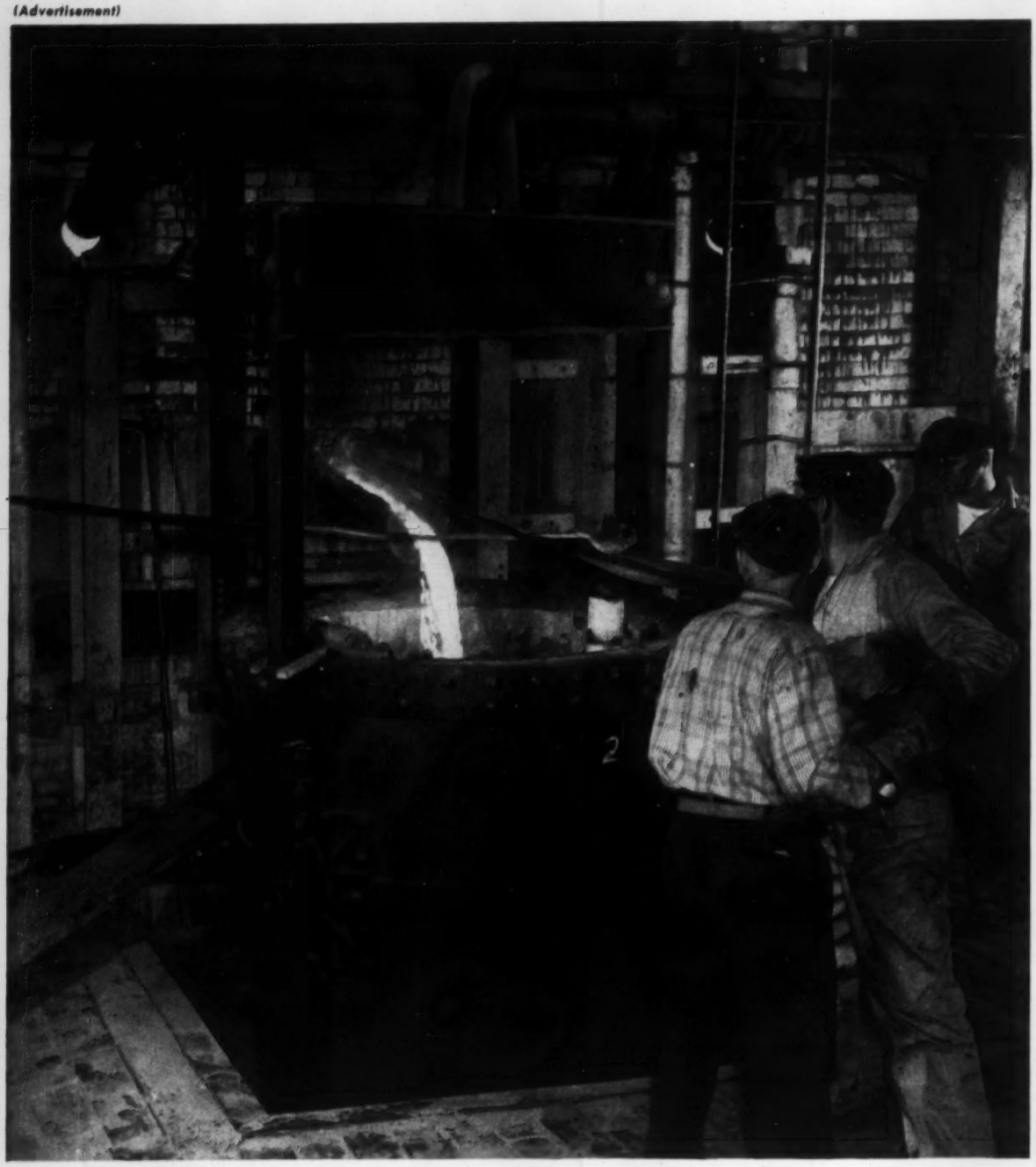


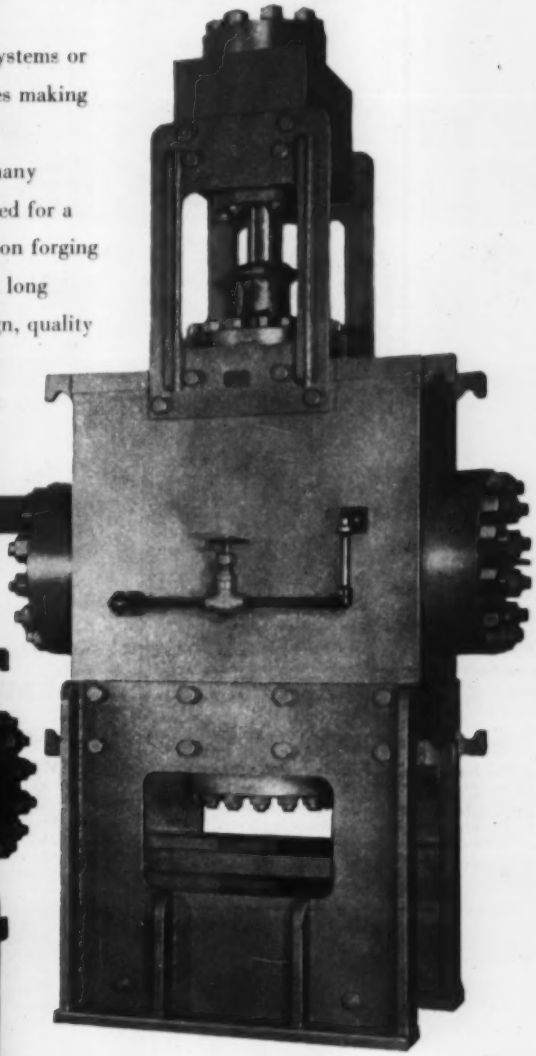
Throughout America, industry improves production, thanks to *GAS*

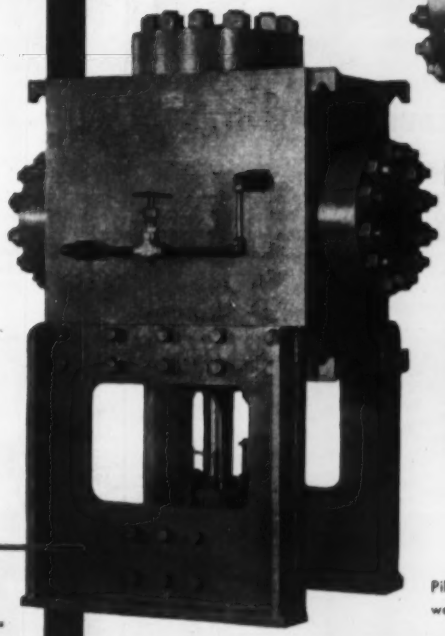
This is an open hearth furnace, fired by natural gas, at the International Nickel Company. Here, during the initial step in the production of malleable nickel for processing into commercial forms, Gas is used because it economically produces temperatures around 2900°F. Later, Gas works as a production line tool, insuring the bright finish of the metal and softening it in a continuous annealing furnace for further processing. This flexibility, plus its cleanliness, economy, and dependability, makes Gas the satisfactory method of heat processing. That's reason enough for discussing your problem with your Gas Company's industrial specialist.

American Gas Association.

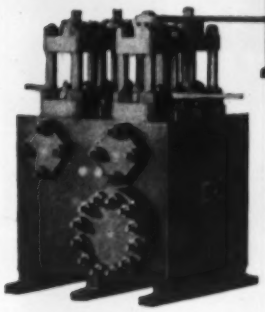
SPECIALISTS IN HIGH-PRESSURE VALVES

When you need a *special* valve—for hydraulic presses and systems or allied hydraulic equipment—call on R. D. Wood. Besides making a complete line of standard valves, we design, engineer and manufacture highly complex valves of many types for many purposes. The three shown here are representative valves used for a hydraulic system, 4500-pound working pressure, for a 35,000-ton forging and forming press. In these, as in all R. D. Wood products, long life and efficient operation are guaranteed by precise design, quality materials and craftsmanship of the highest order. Send for complete details on R. D. Wood high-pressure hydraulic valves.





5" Multiple Spindle Combination Air Valve, 4500-pound working pressure. Height, 5 feet; Width, 3½ feet.



Pilot operated 12" Balanced Stop Valve, 4500-pound working pressure. Height, 13 feet; Width, 6½ feet.

Pilot operated 12" Safety Shut-Off Valve, 4500-pound working pressure. Height, 9 feet; Width, 6½ feet.

R. D. WOOD COMPANY

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A COMPLETE LINE OF AIR & HYDRAULIC CYLINDERS

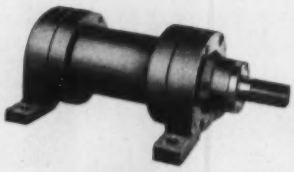
Here is what to expect in a Lindberg RED CAP:

A rugged, dependable, long service cylinder that will do the job month in and month out. RED CAP identifies the famous line of Lindberg air and hydraulic cylinders, now made by Teer-Wickwire. These fine products are backed by expert engineering, made in a new plant equipped with latest type production machines, staffed by men schooled in precision work. New developments are in the works to extend the scope of our service to you. Expect big news from the Lindberg Air and Hydraulic Division of Teer-Wickwire!

AIR CYLINDERS

(low pressure)

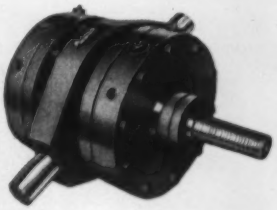
For 150 p.s.i. maximum pressure. Bores 2" through 12" diameter. Heat treated aluminum pistons, cast iron cylinder caps and steel flanges. Retaining rings hold flanges to cylinder. Piston and rod packing, block "V" type.



HYDRAULIC CYLINDERS

(medium pressure)

For 1500 p.s.i. maximum pressure. Ten standard bore sizes, 2" through 8". Seven mounting styles. Standard rods or 2:1 differential rods available. Any length of stroke can be provided.



AIR CYLINDERS

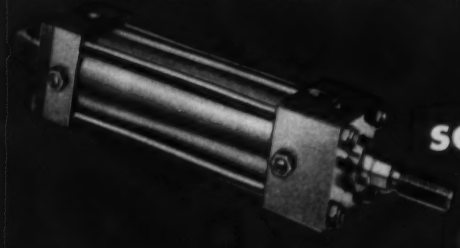
(heavy-duty, mill-type)

For 250 p.s.i. maximum pressure. Thirteen bore sizes from 3" through 24". Six mountings. Constructed of heavy hot rolled steel plate, welded. Strongest possible power unit.

HYDRAULIC CYLINDERS

(heavy-duty)

For 3000 p.s.i. maximum pressure. Ten standard bore sizes from 2" through 8" diameter. Seven mounting styles. Standard rods or 2:1 differential rods available. Cast iron one-piece pistons; steel plate end flanges arc-welded to tube.



NEW SQUARE HEAD TYPE CYLINDERS

Now in the final stages of production testing—new square head cylinders that will set new standards of usefulness.

Compact, cleanly designed, space saving, dependable. Will be available soon in a complete range of sizes and mountings.

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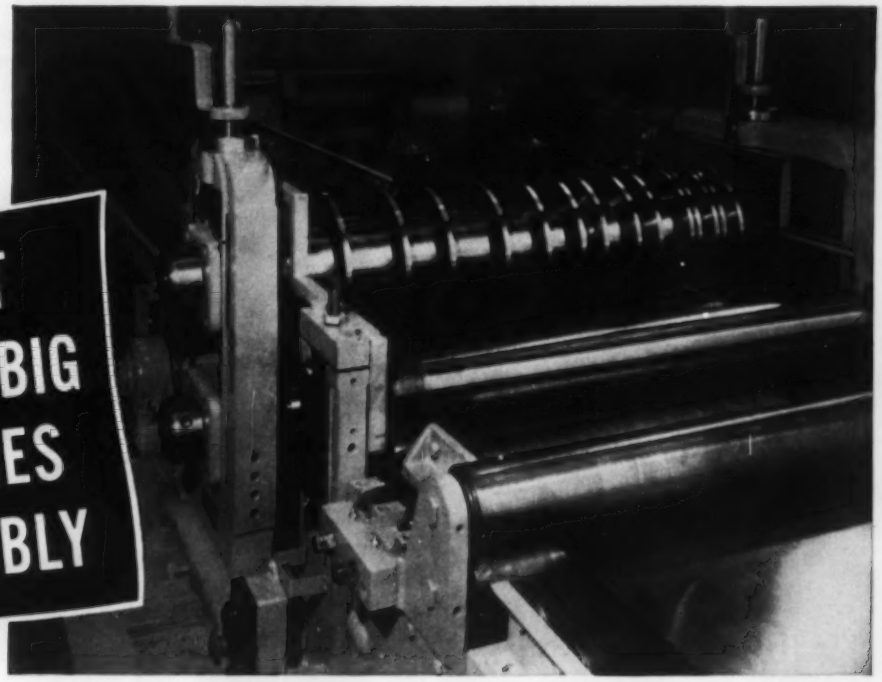
LINDBERG AIR AND HYDRAULIC DIVISION
TEER-WICKWIRE & CO.
JACKSON, MICHIGAN

TO SLIT SMALL or BIG TONNAGES PROFITABLY



Profitable slitting of *big tonnages* is assured with Yoder slitting line units engineered for big coil sizes, with gauges and speeds to suit the needs of rolling mills and other big producers and users of flat rolled metal. Many such Yoder lines have paid for themselves in a few months, and proved exceedingly profitable over the years.

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Because of the great convenience, in addition to the economy, of being able at all times to supply their own requirements in slit strands, to meet expected or unexpected needs, a host of metal fabricators in recent years have installed these Yoder slitters, and the number is growing insistently.

The YODER SLITTER BOOK contains production records, time studies and much other useful data on the mechanics as well as the economics of slitter operations. A copy is yours for the asking.

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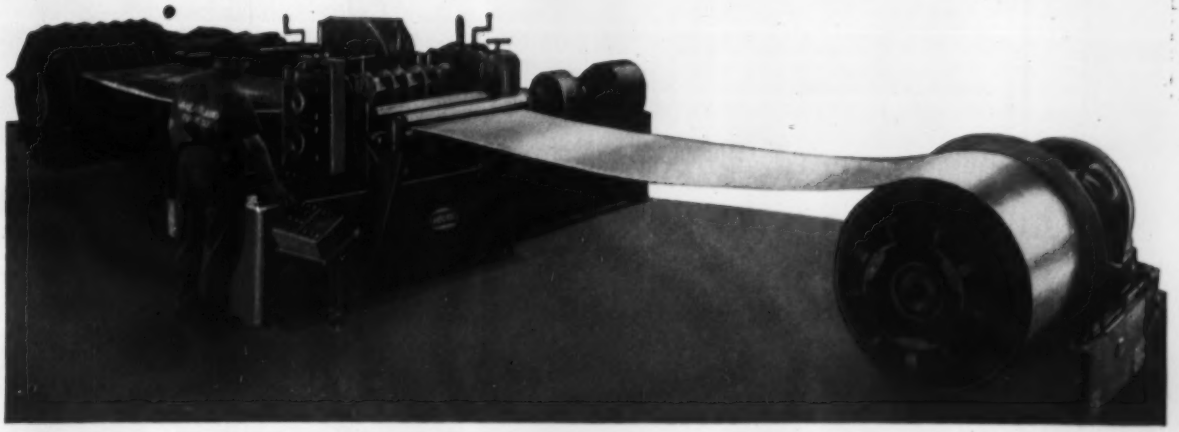
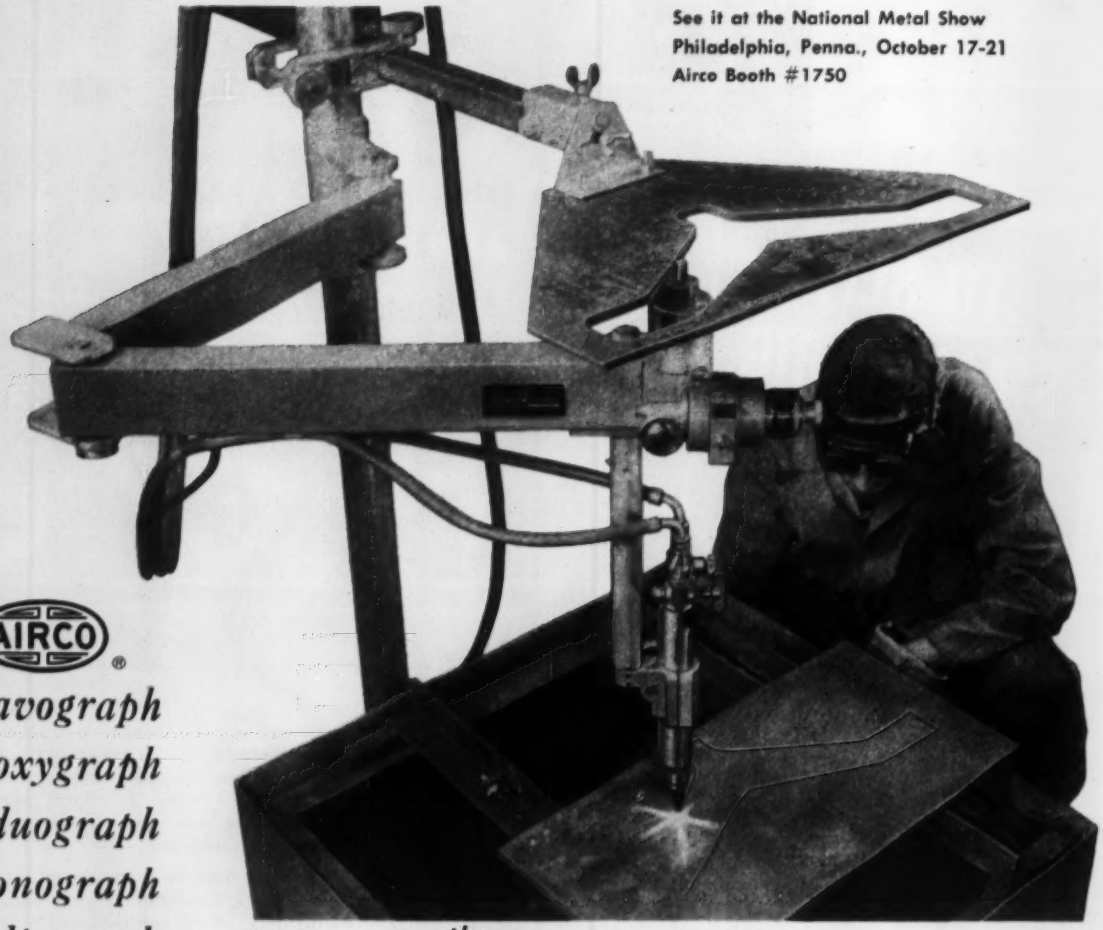


See it at the National Metal Show
Philadelphia, Penna., October 17-21
Airco Booth #1750



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and now the NEW #42 CAMOGRAPH

for repetitive, accurate shape cutting!

The new Airco #42 Camograph is a low-priced, accurate, shape-cutting machine which can be used as a major production tool to turn out thousands of *identical* flame-cut parts – or – as an auxiliary unit to supplement the output of larger, more expensive machines. Here are a few of its many features:

- **Cuts any shape** up to a *full* 42" diameter circle – straight lines to 92".
- **Accommodates wide range** of tip sizes to shape-cut steel of any practicable thickness.
- **Tracer head is permanently magnetized**—operated by an adjustable speed motor.
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See your Airco representative for full details – or—write Airco direct. Request catalog ADC 853.

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world's largest exclusive manufacturer of Tool Steels

—the capacity, the facilities, the skill and the will to serve you better!

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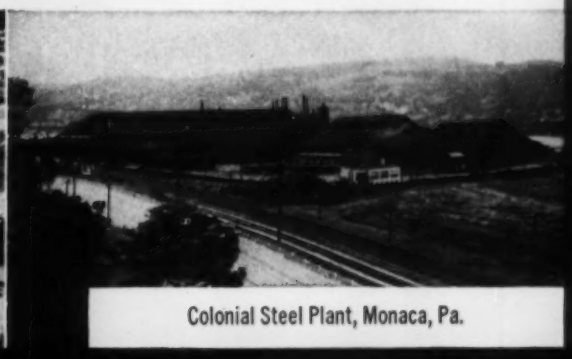
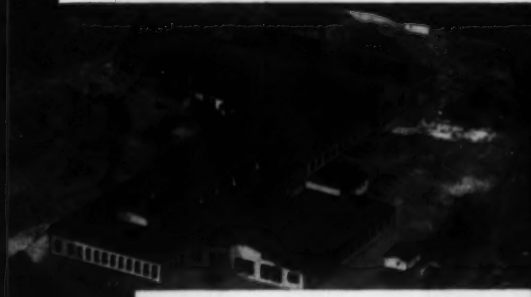


Colonial Steel Plant, Monaca, Pa.



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Facilities of...
COMMERCIAL HEAT TREATERS
can cut YOUR costs

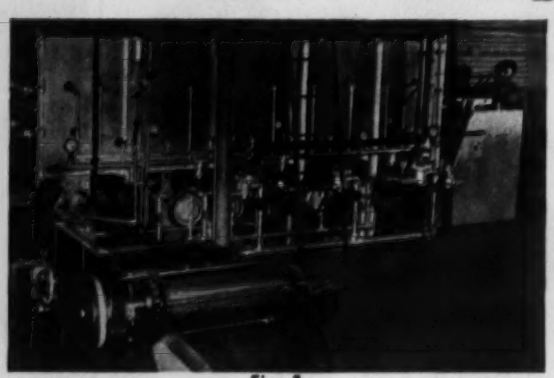

Fig. 1

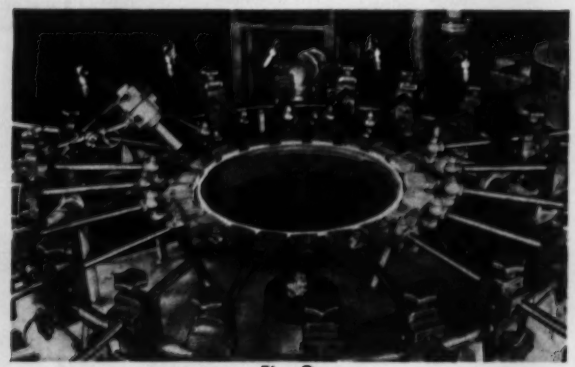

Fig. 2

An MTI commercial heat treater is located near you and is ready to serve your needs by performing "Custom-tailored" heat treating operations.

Because all members of the MTI are specialists with complete service facilities centralized in one plant, they are equipped to offer you a variety of heat treating processes—atmosphere hardening, carburizing, nitriding, annealing, cyaniding, etc.

For example, Fig. 1 shows an installation of a shaker hearth furnace with a continuous automatic quenching tank and a conveyor to a washing machine.

Fig. 2 illustrates a gas flame hardening unit featuring accurate temperature control and using two semi-circular gas manifolds mounted on movable carriages with 20 or more burner heads.

A further example of versatile and dependable equipment found in a commercial heat treating plant is seen in Fig. 3. The specially designed furnace conveyor belt carries over 35 lbs. per sq. ft. in normal service and sometimes as much as 5000 lbs. are loaded on it with pieces ranging from ½ lb. to 100 lbs. and temperatures up to 1650°.

Possessing such equipment together with many other specialized facilities and employing the trained personnel with technical knowledge and experience is the business of the commercial heat treater. Teamwork between you and the commercial heat treater can cut your costs.

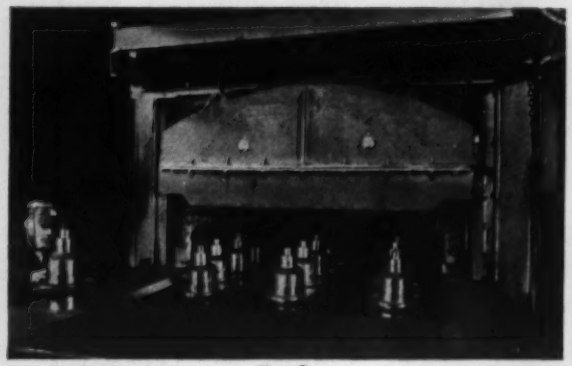

Fig. 3

WRITE FOR *the booklet called:*

"STRATEGIC USE of OUTSIDE HEAT TREATING FACILITIES CAN CUT COSTS."

Consult any of these HEAT TREATING SPECIALISTS

Ace Metal Treating Corp.
Elizabeth, New Jersey
Allied Metal Treating Corp.
Kenosha; Manitowoc; Racine, Wisconsin
Anderson Steel Treating Co.
Detroit, Michigan
B. & W. Precision Heat Treating Co.
Kitchener, Ontario, Canada
Benedict-Miller, Inc.
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Bennett Heat Treating Co., Inc.
Newark 3, New Jersey
Commercial Metal Treating, Inc.
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Drever Company
Philadelphia 33, Pennsylvania
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MTI
METAL TREATING INSTITUTE

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Metallurgical, Inc.
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Kansas City 8, Missouri
Metlab Company
Philadelphia 18, Pennsylvania

Metro Heat Treat Co.
New York 13, New York & Ridgefield, N. J.
New England Metallurgical Corp.
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St. Louis 10, Missouri
Pittsburgh Commercial Heat Treating Co.
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The Queen City Steel Treating Co.
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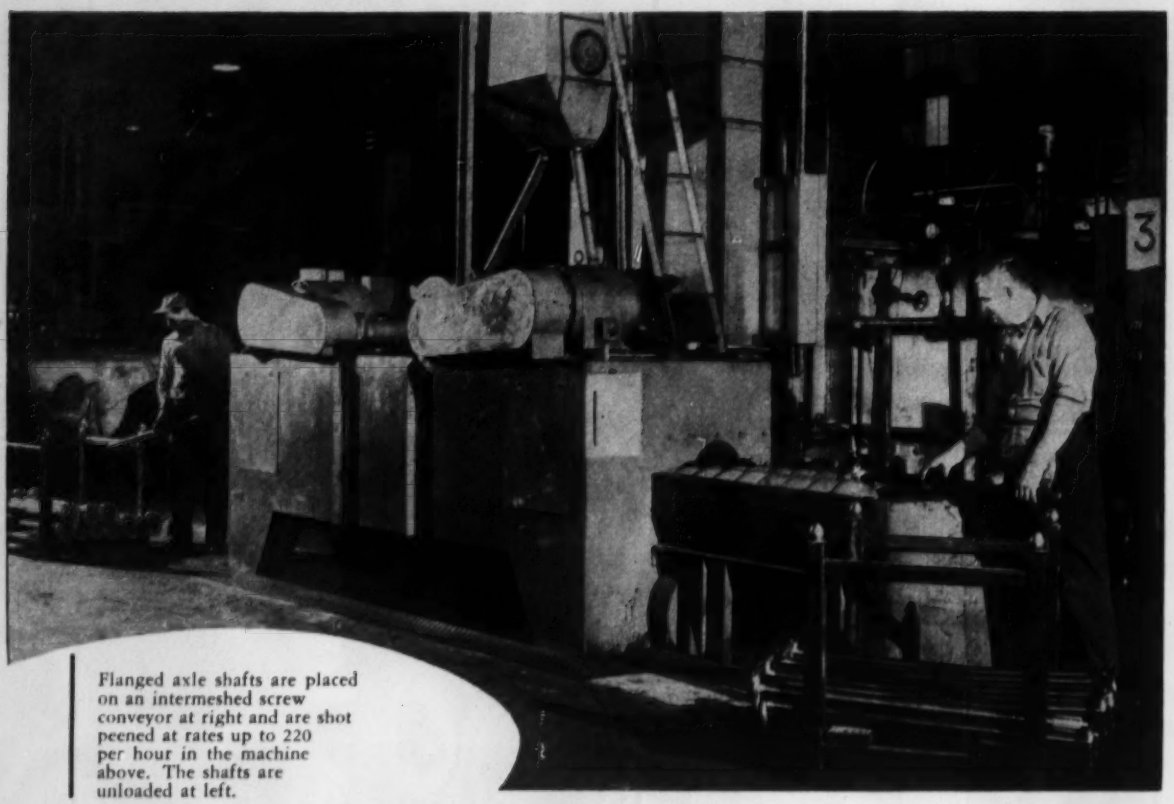
The extras you get in Henry & Wrights — and only in Henry & Wrights — provide that margin of operating safety and efficiency you want for immediate and prolonged savings in stamping costs. Step up to a Henry & Wright to be sure of peak performance.

Our catalog is yours for the asking. Please write Henry & Wright, Division of Emhart Mfg. Co., 441 Windsor St., Hartford, Connecticut.

The most efficient metal stamping method known...

HENRY & WRIGHT DIVISION OF EMHART MFG. CO. **HARTFORD, CONNECTICUT**



Flanged axle shafts are placed on an intermeshed screw conveyor at right and are shot peened at rates up to 220 per hour in the machine above. The shafts are unloaded at left.

WHEELAPEENING HAMMERS LIFE INTO AXLE SHAFTS AT DETROIT BEVEL GEAR COMPANY

Auto makers specify shot peening to increase fatigue life of parts

Tests by leading automotive manufacturers have proved shot peening will increase fatigue life of axle shafts up to 1900%.

With shot peening virtually eliminating axle failure in normal service, passenger car and truck manufacturers now specify such peening by their suppliers.

Detroit Bevel Gear Co. has found a Wheelabrator cabinet is the answer for peening in sufficient quantity to meet the demands of high-volume production. Up to 220 axle shafts an hour are shot peened in the Wheelabrator.

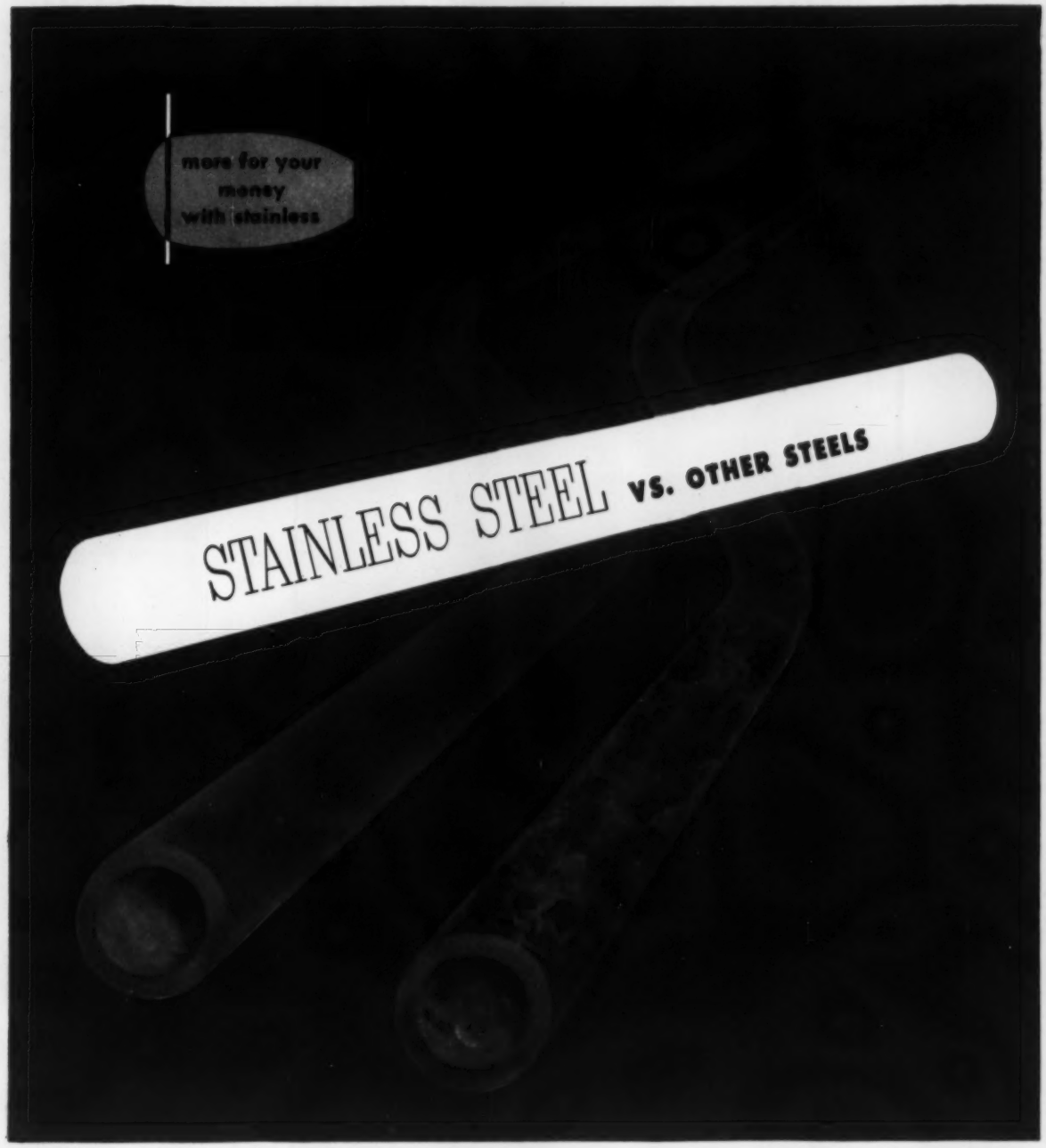
To assure that peening in production is uniform and as specified, a special test axle shaft on which two Almen test strips are affixed, is passed through the machine at certain intervals. Tagged and filed, these strips are proof to the customer that the peening arc height has been kept within specified limits for the entire run.

Although the machine was installed especially for peening, its high speed also permits cleaning rough forgings at rates up to 245 an hour, compared with 30 shafts cleaned in the same time previously in a batch type blast mill.

To learn more about the Wheelabrator and how it provides faster and better production, write today for Bulletin No. 74-B.

WHEELABRATOR
CORPORATION
(Formerly American Wheelabrator & Equipment Corp.)

509 S. Byrkit St., Mishawaka, Indiana



Regardless of present conditions it is often difficult to predict future operating requirements. A generous safety factor should be allowed for all possible conditions of corrosion, oxidation, pressures and temperatures. In the range of B&W stainless steels will be found the answers to virtually all of these conditions. It's easy to anticipate substantial savings in downtime and labor costs in replacing worn-out tubing made from less hardy metals. Be sure with B&W stainless.

Get in touch with Mr. Tubes, your link to B&W, for the story of how you can get more for your money with stainless tubing. *Or write for Bulletin TB 1S.*

B&W
TUBULAR PRODUCTS DIVISION

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION

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TA-5035(P)

THE NEW BOSTON GEAR 100 SERIES SPEED REDUCTION UNITS

Every feature you want- any model you need - *FROM STOCK*

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CERTIFIED ratings
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NEW clean contours
NEW gearing efficiency
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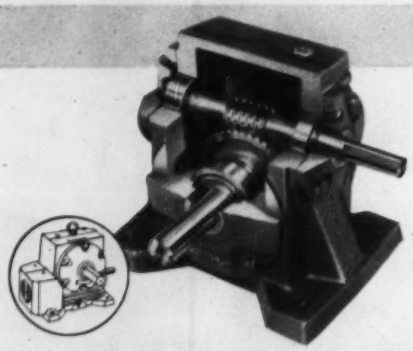

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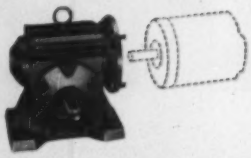
— all new features of Reductors plus NEW *Combination* CONSTRUCTION

A complete power package — gear reduction unit and easily detachable standard end-mounted motor — combined for peak performance, easy adaptability, big maintenance savings. Permits (1) replacement of motor without disturbing gear unit. (2) Replacement of original motor at any time with motor of special characteristics (totally-enclosed, etc.).

FLANGED REDUCTORS The Ratiomotor gear reduction unit, supplied *without* motor. You buy and attach the motor of your own choice.



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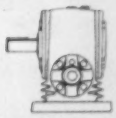
NEW CATALOG

R-56

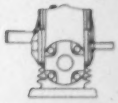
gives complete details, selection charts, engineering data. Get your copy.



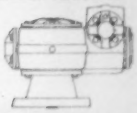
Horizontal Right Angle Drive Worm gear on top

Horizontal Right Angle Drive Worm gear under

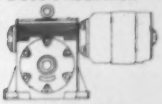
Vertical Right Angle Drive



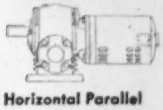
Horizontal Parallel Drive Double Reduction



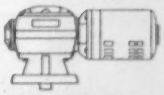
Vertical Right Angle Drive Double Reduction



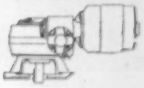
Horizontal Right Angle Ratiomotor



Horizontal Parallel Ratiomotor Double Reduction



Vertical Right Angle Ratiomotor



Vertical Right Angle Ratiomotor Double Reduction

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108 MODELS

1064 STANDARD STOCK UNITS

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for complete information — or write: Boston Gear Works, 73 Hayward Street, Quincy 71, Massachusetts.

Look under "GEARS in the Yellow Classified Section of your Telephone Directory for the BOSTON Gear Distributor nearest you. 55 BG-R-13

50-ton crane becomes 85-ton crane

with no increase in size

United States Steel's Edgar Thomson Works in Braddock, Pennsylvania, needed new and heftier crane equipment to handle larger ladles. One requirement was four new crane trolleys which were to operate on the same bridges, if possible, and in exactly the same clearances as before.

The trolleys had to be stronger but no larger than before; so ordinary steel wouldn't do. Needed, was a steel of *exceptional strength* which could be *welded easily*. Lots of alloy steels could have met the strength requirements; but USS "T-1" Steel was the *only* steel that could supply not only the required strength, but good weldability as well.

"T-1" Steel plate—in ¾" and 1" thicknesses—was used in box girders and lateral stiffener plates of the trolleys. This change increased the crane capacity from 50 to 85 tons with no increase in size.

The structure was welded with AWS E12015 electrodes. It was as easy as welding carbon steel. No stress relief was needed. And the welds developed the full yield strength of the steel: 90,000 psi. minimum.

Remember this story when you must weld very high strength parts —parts that must operate at temperatures as high as 900°F. or as low as 40°F. below zero, parts that must withstand tremendous impact abuse, abrasion or tensile stress. Then consider USS "T-1" Constructional Alloy Steel. For full particulars write: United States Steel, Room 4983, Pittsburgh 30, Pa.

UNITED STATES STEEL CORPORATION, PITTSBURGH · COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. · UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

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USS "T-1" CONSTRUCTIONAL ALLOY STEEL

USS

UNITED STATES STEEL

2 Stainless Parts

made to the same specs... but what a difference!

Machining costs are 25% lower

This valve is used for a fuel return regulator check. Although the manufacturer was one of the first to use Carpenter Stainless No. 8 (Type 303) when it was first introduced, there have been occasions and conditions which required the use of ordinary makes of Type 303 Stainless Steels. The customer reports: Carpenter No. 8 *consistently* enables them to show a 25% saving in machining costs because of its constant uniformity and easier machinability.

Reject rate is reduced

An important requirement of this valve is that it be "leak-proof" in operation under pressure. To assure a tight seal, some surfaces are machined to a 5 or 10 micro-inch finish with tolerances as close as .0005". Because of the machinability and finishes obtained with Carpenter No. 8, rejects always take a sharp drop when compared with competitive Type 303 Stainless Steels.

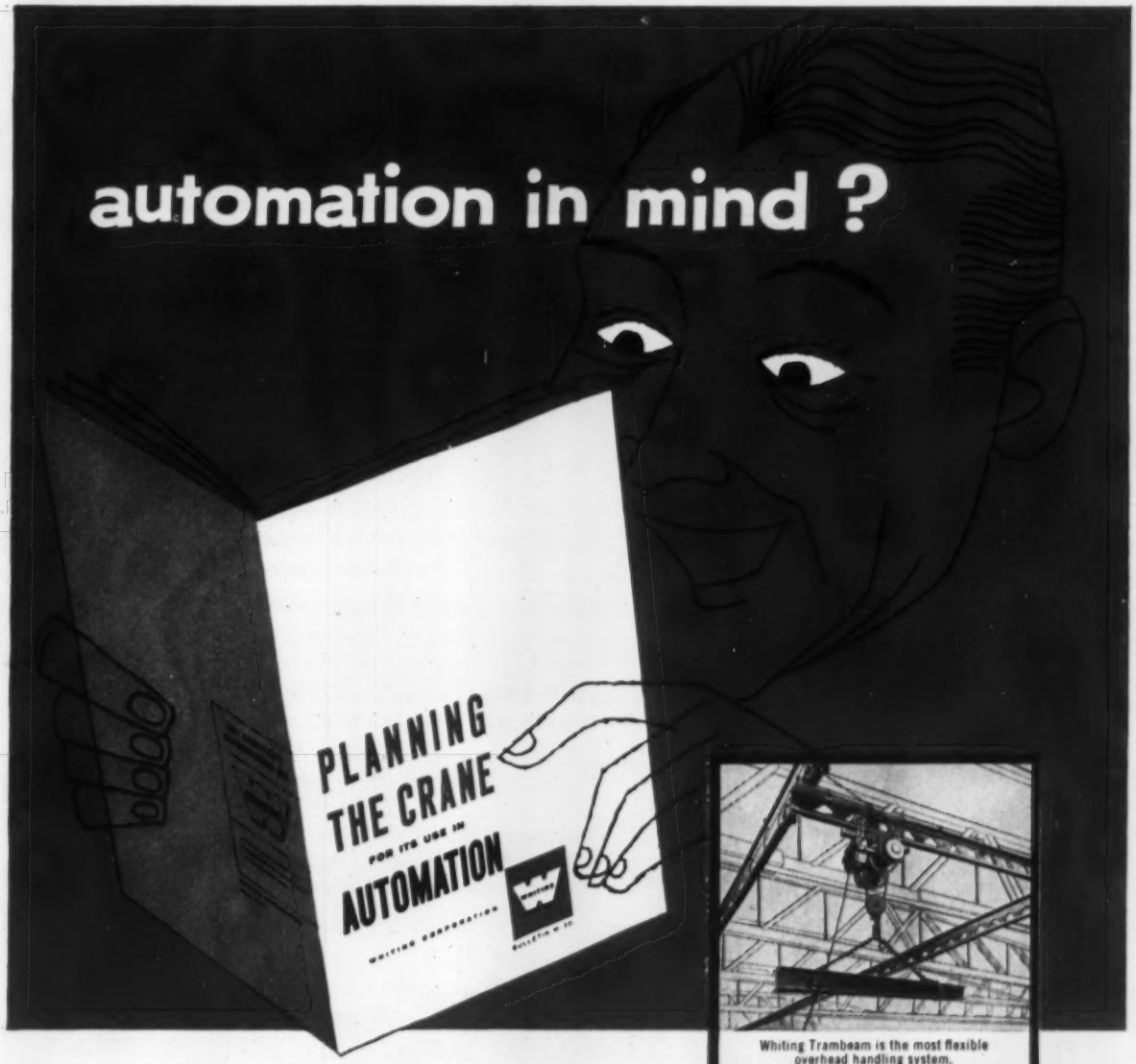
Machine operators are happier

Here's an interesting sidelight: Machine operators can always spot an ordinary Type 303 without being told, because of the way it cuts in the machines. With Carpenter No. 8 they tell us they *know* the job will run smoother and faster with improved results. The same thing can apply in your *own* plant. So if you're looking for a way to improve performance and reduce costs on your stainless parts, CHANGE to Carpenter No. 8. See what the difference can mean to you.

take the problems out of production

...change to Carpenter STEEL — **Free-Machining Stainless**

IMMEDIATE DELIVERY from local warehouse stocks!
THE CARPENTER STEEL CO., 139 W. Bern St., Reading, Pa.
Export Department: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"



Whiting Trambeam is the most flexible overhead handling system.

PLAN TO SPEED "FLOW" WITH OVERHEAD CRANE HANDLING!

Read the Whiting just-published 12-page booklet "Planning the Crane for Its Use in Automation!" It gives important information regarding the various types of overhead cranes . . . top running, underhung, monorail and gantry. It will help you determine the best system to handle your materials or products . . . quickly, smoothly, and at lower cost. Written by a specialist with many years of practical experience in solving handling problems, it will be of interest and value to *you*. Write today for your copy of Bulletin M-30.

WHITING CORPORATION

15643 Lathrop Avenue, Harvey, Illinois

Manufacturer of Overhead Cranes; Trambeam Handling Systems; Trackmobile; Foundry, Transportation and Chemical Processing Equipment.

WHITING

Whiting Engineered Cranes handle big loads up to 500 tons.

THE RED CIRCLE *is your Guarantee!*

RED CIRCLE Rolls ALLOY-CHILLED

18" 3 Hi Bar Mill

Chilled Iron Hydraulic Rams

Hyde Park Red Circle Rolls are known by the red circle on the end of the roll—it is the mark of quality.

For over fifty years Hyde Park Red Circle Rolls have been giving top production and achieving new endurance records in many mills throughout the country.

A Red Circle Roll for every purpose.

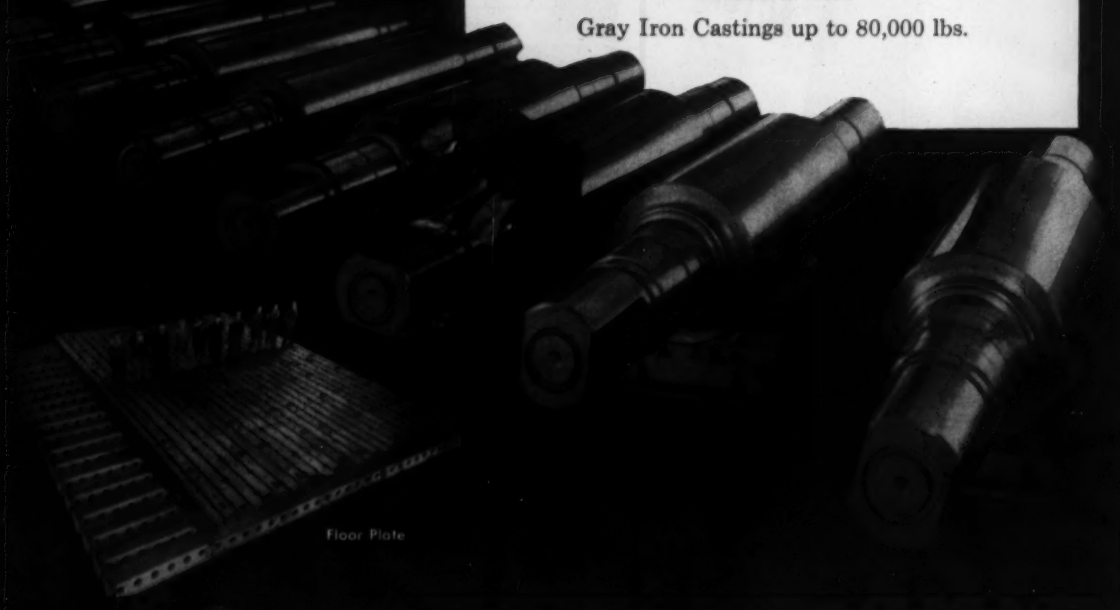
Chilled Rolls • Alloy Iron Rolls • Moly Rolls • Nickel Chilled Rolls • Grain Rolls • Cold Rolls • Sand Rolls Chilled Hydraulic Rams

Rolling Mill Equipment

Hyde Park Rolling Mill Equipment is extra rugged to withstand the increasing demands of production. Our engineers will be glad to co-operate with you regarding any special mill equipment.

Bar Mills • Merchant Mills • Sheet and Strip Mills • Pinion Stands • Roller Tables • Reduction Drives • Stretcher Levellers • Guillotine Shears • Sheet Mill Shears • Roll Lathes • Special Machinery • Machine Work

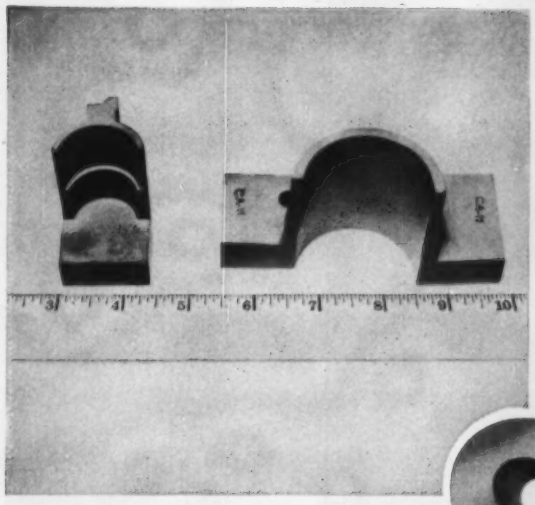
Gray Iron Castings up to 80,000 lbs.

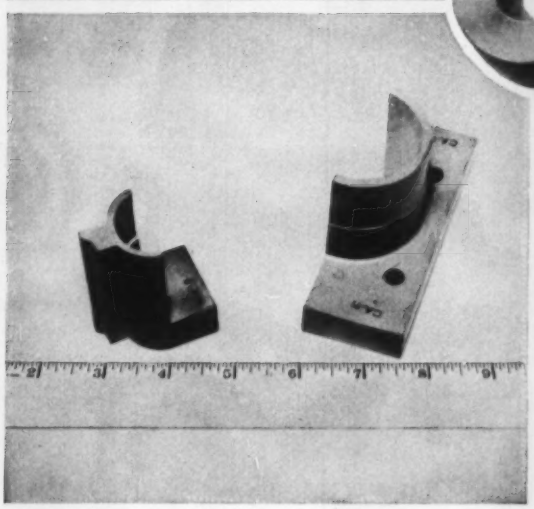


Floor Plate

FOUNDRY & MACHINE CO.

HYDE PARK, WESTMORELAND COUNTY, PITTSBURGH DISTRICT, PA.





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DIE SECTIONS

these Blanks are preformed to a Finishing Allowance of .018"-.022" per side

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Just out . . . 32 well-illustrated pages, containing data on all Carmet grades, and on Carmet blanks, tools, die sections, punches, draw die inserts, etc.; also special preforming to order. ● *Write for your copy.*

ADDRESS DEPT. S-70

These tungsten carbide die sections are of Carmet CA-11, a special grade developed expressly for punches, dies, and other heavy shock applications where wear and abrasion resistance are required.

These blanks have a span of 1.315" with a wall thickness of only .046", but they were easily produced to close tolerances by AL's precision preform methods. All surfaces are clean, smooth and free from defects, requiring only a minimum amount of grinding to final dimensions.

Carmet carbides can be accurately produced to practically any shape or size your designs may require, and can be supplied preformed as desired. Typical highly successful applications include inserts for drawing, heading, extruding and blanking dies; gauge and wear parts; pins; bushings; etc.

Find out, TODAY, how you can cut costs with preformed Carmet. Write or call *Allegheny Ludlum Steel Corporation, Carmet Division, Wanda and Jarvis Avenues, Detroit 20, Mich.*

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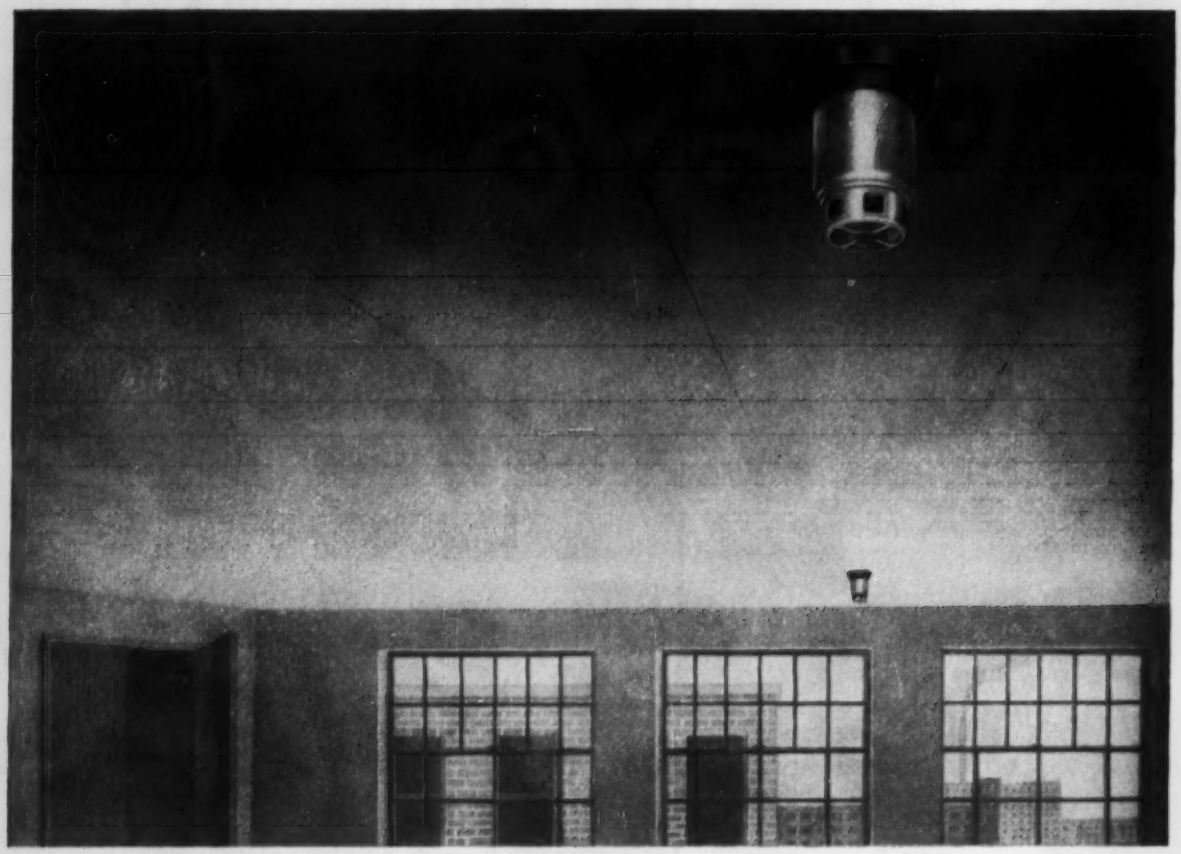
AL® FINE TOOL STEELS SINCE 1854

New, radio-active, automatic fire guard!

C-O-TWO PRE-DETECTOR SYSTEM



Each pre-detector head protects up to 3,600 square feet of area . . . harmless radio-active element utilizing ionization chamber principle quickly detects all forms of fire . . . requires only simple two-wire circuit and insignificant wall space for controls.

This completely new and positive means of spotting fire is just what you've always needed and wanted . . . detects in the earliest stage, invisible combustion gases, visible smoke, slow smoldering, as well as open flame. The C-O-TWO Pre-Detector System is simple to install, extremely economical to maintain and doesn't depend on thick smoke or heat for actuation.

As many pre-detector heads as necessary can be connected together in a single circuit and up to 16 separate circuits or spaces handled by one system. With a single circuit the pre-detector heads are connected directly to the fire indicating cabinet, while with multiple circuits the pre-detector heads are first connected to one or more space indicating cabinets capable of visually showing by number the exact location of the fire. Relays perform such functions as sounding alarms, closing fire doors, shutting down ventilation and releasing fire extinguishing systems.

The C-O-TWO Pre-Detector System has been subjected to extensive testing and carries Underwriters' Laboratories, Inc. listing, as well as Factory Mutual Laboratories approval. Proven pilot installations have been made in such diversified properties as a television station, an electric power company network analyzer room, a railroad signal tower, an airline flight training equipment room and the offices of an insurance company.

Don't take unnecessary chances any longer . . . the extensive fire protection experience of PYRENE—C-O-TWO over the years is at your disposal without obligation. Get complete facts about this new C-O-TWO Pre-Detector System today!

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COMPLETE FIRE PROTECTION

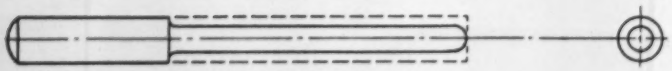
portable fire extinguishers . . . built-in fire detecting and fire extinguishing systems

CARBON DIOXIDE • DRY CHEMICAL • VAPORIZING LIQUID • SODA-ACID • WATER • CHEMICAL FOAM • AIR FOAM

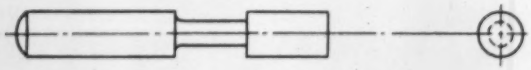
40 YEARS
of quality metals . . .
1962 marks 40 years of quality alloys by Titan metal specialists. Brass and bronze free-cutting rods, extruded brass shapes, bronze welding rods, brass wire, aluminum and brass hand screw-machine parts, brass pressure die castings, brass, bronze and aluminum forgings are produced to meet high standards and rigid requirements. Titan Metal Manufacturing Co., Bellefonte, Pa. Offices and agencies in principal cities.

Swaging Success Stories

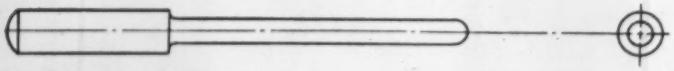
Close Tolerances... without Machining



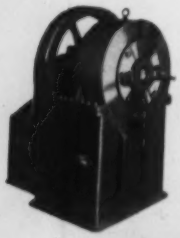
This finished piece used to be made on an automatic screw machine with the long, narrow diameter section turned to .100 ±.003 and a necessary sharp shoulder.



Torrington's swaging experts suggested starting with this simple screw machine blank (to retain the required shoulder).



Result after one rotary swage—an improved finished piece, to a tolerance of ±.001.



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Swager Department
150 North Street, Torrington, Conn.
Makers of Torrington Needle Bearings

Why not write for our informative booklet on swaging that includes complete descriptions of Torrington Rotary Swagers. It may show you how you can achieve a "swaging success story" in your own plant.

See what savings you can make by swaging

1. Saving in material—swaging uses nearly all the metal.

2. Saving in time—swaging is fast.

3. Saving in labor—unskilled labor can run a swager.

4. Saving in machining—swaging produces finishes accurate to ±.001.

5. Saving in finishing operations—swaging produces high finish, better hardness and resiliency.

TORRINGTON ROTARY SWAGING MACHINES

Remington Rand

BETTER BUSINESS METHODS

For Greater Profits Through Lower Costs

SAVED...More Than $48,000 Annually with Kardex Inventory Control!

The use of Remington Rand Kardex Visible Systems for materials control and inventory records produces savings that are almost unbelievable. Consider the experience of the Baldwin-Lima-Hamilton Corporation of Eddystone, Pennsylvania, one of the world's largest manufacturers of diesel locomotives. This organization now realizes savings of more than $48,000 each year in their Renewal Parts Inventory alone as a direct result of switching to Kardex. With Kardex, two clerks now replace the five formerly required; they do more work and handle customer orders more quickly. With Kardex, the availability of material is indicated immediately—*before* orders are sent to the plant for processing.

These are but two of the many advantages of Kardex that add up to more than $48,000 annually for this manufacturer. Learn more about how it's done by circling CH992. Learn more about Kardex and how this remarkable, money-saving system may be employed by you by circling KD406 for your free copy of "Kardex Inventory Control."

Simplified Payroll Accounting with Punched-Card Methods

Modern-day payroll accounting has become an increasingly complicated and costly business operation. The answer to this problem lies in punched-card accounting procedures. Remington Rand produces punched-card equipment necessary to handle all possible variations in payroll accounting with lightning speed and unfailing accuracy. You can learn more by circling SPTM4155 Rev. 2.

Increased Production with the Transcopy Duplex

Manufacturer after manufacturer is discovering how to expedite production with the Remington Rand Transcopy Duplex photocopying machine. At the El Segundo Division of the Douglas Aircraft Company, Inc., for example, Remington Rand Transcopy Duplex machines are replacing typewriters for the exacting work of duplicating Manufacturing Outlines. North American Aviation, Inc., of

Columbus, Ohio, expedites and adjusts factory production orders at but a fraction of what this work used to cost, eliminating typographical errors entirely.

To learn in greater detail how these two manufacturers are expediting production with the aid of the Remington Rand Transcopy Duplex, circle CH1017.

Remington Rand

DIVISION OF SPERRY RAND CORPORATION

Room 2048, 315 Fourth Ave., New York 10

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CH992 KD406 CH1017

SPTM4155 Rev. 2

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127

Profit-Building **IDEAS** For Business

OUTLOOK META
METALWORKING
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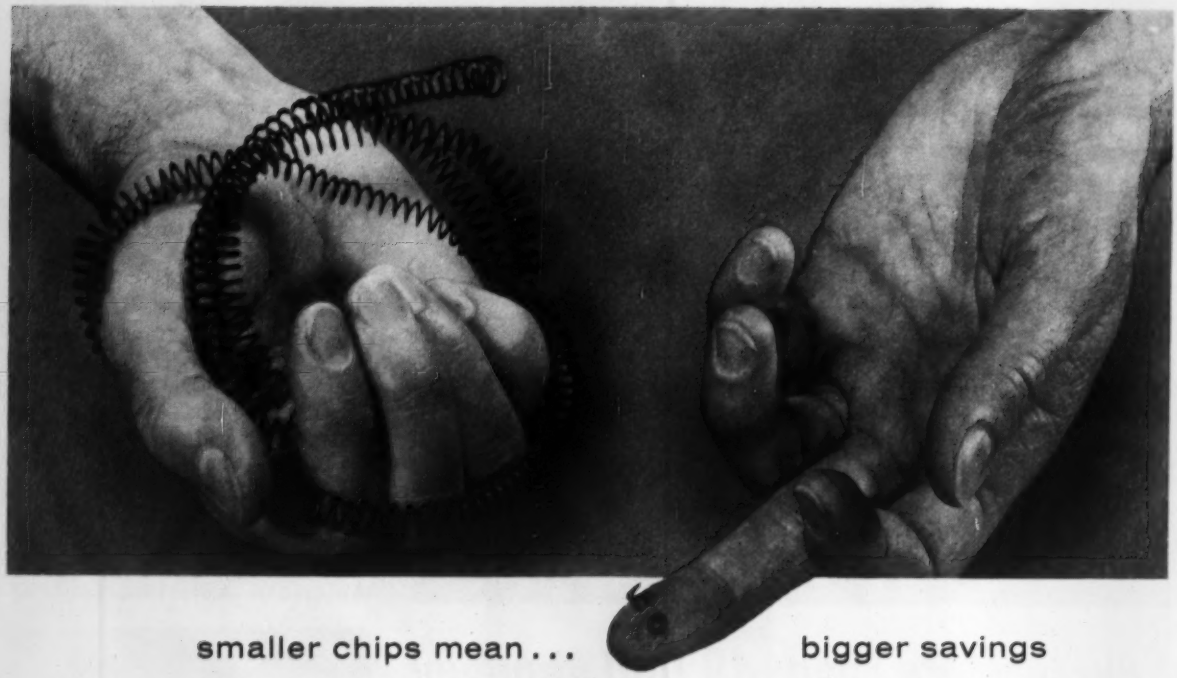


smaller chips mean . . . bigger savings

Cut costs with RYCUT steels!

Three new Ryerson leaded alloys

These short, fast-breaking chips have real meaning to cost-conscious purchasing and production men. In an ever-increasing number of shops, small chips like these mean that the switch has been made to Rycut steels. They mean that tools are turning faster—that production is up as much as 200%.

The secret of Rycut's machining speed is a minute quantity of lead, finely dispersed throughout the steel. This acts as a lubricant between tool and steel. The results are revolutionizing machine shop practice:

- Up to 200% more parts can be produced per machine hour!
- Tool life is lengthened as much as 300%!
- Finish is improved!

There's a Rycut leaded alloy for every application. Use RYCUT 20 when you need a carburizing alloy; RYCUT 40 for .40 carbon alloy applications; and RYCUT 50 for .50 carbon alloy uses. Every one is a cost-cutter.

Figure how much this increased production and longer tool life would lower costs in YOUR shop—and raise your profits! Call your nearby Ryerson plant today . . . large stocks assure you of quick shipment.

See RYCUT 40 machined at the National Metal Exposition, Booth 931

See tool life lengthened 300% in machining demonstration of RYCUT 40 vs. AISI 4140.

Flame cutting also demonstrated—Watch the actual burning of intricate steel shapes with electric-eye equipment.

RYERSON STEEL

In stock: Bars, structurals, plates, sheets, tubing, alloy and stainless steel, reinforcing bars, machinery & tools, etc.

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • CHARLOTTE, N. C. • CINCINNATI • CLEVELAND DETROIT • PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE

Metalworking Outlook

Tool Shipments Sharpen Up

Look for 1955 machine tool orders to reach $800 million, topping an earlier forecast of $700 million. Tool orders in 1954 totaled only $560.4 million. Good results at the machine tool show account for the improvement this year. Machine tool shipments, slowed during the summer months by plant vacations and pre-show preparations, turned slightly higher in August, at $48.8 million. Count on a steady increase in shipments for the rest of the year.

Ford: Expanding Again

Ford Motor Co. will spend $500 million for expansion in 1956. The money will come from earnings, not borrowings. Henry Ford II made the announcement of the record plans at the opening of the new Ford assembly plant at Mahwah, N. J. By 1988, an estimated 8 million vehicles will be turned out at the facility which will contribute nearly $18 million to the nation's economy.

Money Talks

Here's a look at the future by still another Ford, James D., assistant treasurer of National Steel Corp. He predicts: $230 billion will be needed in the next decade for replacement of worn-out facilities in industry and business. An additional $350 billion will be needed to provide additional jobs and to give a solid foundation to America's rising standard of living which will increase an estimated 20 to 25 per cent in the next ten years.

Accent on Distribution

Only infrequently can the commercial publishing industry write a success story comparable to that of the Commerce department's *Distribution Data Guide*. Just a year ago, the department launched the first issue of the publication; it now has more than 10,000 subscribers. Editorially, the publication is simple. It carries annotations of current publications and a listing of reports and articles that have appeared in periodicals during the month which would appeal to people in distribution. Significance: Industry men are showing new interest in the distribution end of our economy.

Budget in the Balance

Defense department spending for August was $3125 million, an increase of more than $200 million over the spending rate in August, 1954. The increased spending level occurs for the second month in fiscal 1956 and shows the difficulty of reaching a Budget bureau target for the Pentagon of $34 billion or less. Defense spending in fiscal 1955 amounted to $35.5 billion. Treasury Secretary George Humphrey says he's still "hopeful" of a budget balance, but he also agrees that programs and force levels

Technical Outlook—p. 137 Market Outlook—p. 259

should not be scaled down below those established some months ago by the President.

Easing the Nickel Pinch

Keep your eye on a research program to develop an improved method of recovering nickel and cobalt from the Nicaro laterite and serpentine ores of Cuba. If successful, the development could help relieve the nickel shortage. The program has been undertaken by the Bureau of Mines, Battelle Memorial Institute and the Nickel Processing Corp., current operator of the government-owned Nicaro property. The work is under contract with the General Services Administration.

Flood Control: Bogged Down?

How well along are we in our flood control programs? Not too far, reports Lt. Gen. S. D. Sturgis Jr., chief of engineers, U.S. army. In the U.S. no major river-basin program is more than half complete. Of the $9 billion worth of "active" projects—developments authorized by Congress—only $3.6 billion, or a little more than one-third, have been built. Says the general: "Either the memory of man is short or he has an abiding faith that the good Lord is only going to use one-third size floods in the future."

Workingman's Wage

A U.S. worker employed in manufacturing can buy one of the three leading low-priced American cars (standard four-door sedan, no "extras") for the equivalent of about 28 weeks of work. The National Industrial Conference Board reports that the United Kingdom employee would have to work nearly 42 normal U.S. (40-hour) workweeks and the German worker about 61 weeks to purchase their new cars.

Red Feather Wrinkle

With Red Feather campaigns coming up, you may want to take a tip from Chicago Screw Co. and Local 59 of the UAW-CIO. Some 1600 employees in the first and second shifts will work special 4-hour tricks Saturday, Oct. 22. All or any part of the extra pay may be contributed by the workers to the chest. Also the company makes a contribution (last year it was $10,000), based largely upon the extra day's income. That sum is distributed proportionately to the fund of the community which the individual employee designates.

Straws in the Wind

National Lead Co. has discovered new deposits of titanium ore in Norway, New York and Florida . . . Goodyear Tire & Rubber Co. is spending $100 million in a two-year expansion . . . More than half the members of the United Auto Workers are now under SUP . . . The Treasury and the Department of Health, Education & Welfare in the next session of Congress will push H.R. 7770. It would reduce paper work required of employers in reporting social security taxes.

OUTLOOK METAL
METALWORKING
OUTLOOK METAL

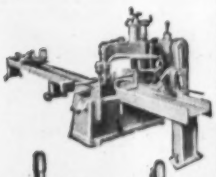
Metal Sawing is of many types

Requiring, for efficiency, sawing machines of varying characteristics, capacities, feed pressures, speeds . . . even different blade actions. The complete MARVEL Line comprises various basic types of metal sawing machines to meet the requirements of all shops.

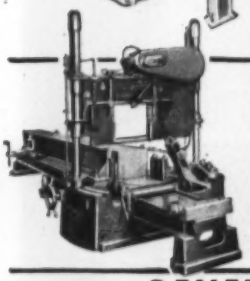
Engineered to your jobs by a MARVEL Sawing Engineer, a MARVEL Saw is certain to lower your sawing costs (both blade cost and cost per piece); to cut-off more accurately (both in length and squareness) and to out-produce any other sawing machine of comparable specifications.

PRODUCTION HACK SAWS

TYPE	CAPACITY	MODEL	GENERAL APPLICATION
HACK SAW Single Cut	6" x 6"	No. 6	These machines embody all of the modern design features of fine machine tools. They are recommended for constant heavy duty service, cutting all types of machinable metals. They should be selected whenever the work demands speed, accuracy, and stamina.
	10" x 10"	No. 9	

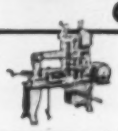


HACK SAW Automatic Bar Feed	6" x 6"	No. 6A	These automatic MARVEL saws use the No. 6 and No. 9 as a basic unit, but are modified to include an automatic mechanical bar feeding mechanism. Their purpose is to automatically "cut-up" long bars into multiple short length pieces without constant attention of an operator.
	10" x 10"	No. 9A	
HACK SAW Dual Bar Feed	10" x 10"	No.9A3	The No. 9A3 machine combines full automatic operation and manually controlled power bar feed, the latter for lengths beyond practicability of full automatic operation.



HACK SAW Hydraulic Roll Stroke Single Cut	18" x 18"	No. 18	These big saws are proof that the hack saw method is the most practical for cutting off big pieces of the toughest steels. Low investment, economical operating and maintenance cost, accuracy and cutting speed make these machines an ideal tool for the steel mill, warehouse and forge shop.
	24" x 24"	No. 24	
HACK SAW Power Work Handling Type	18" x 18"	No.18B	The No. 18-B is a special structural saw, primarily designed to obtain accuracy to such a degree in cutting structural shapes that subsequent face milling is not required.

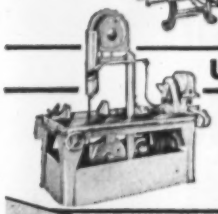
GENERAL PURPOSE HACK SAWS



TYPE	CAPACITY	MODEL	
HACK SAW Single Cut	6" x 6"	No. 4B	This saw is fast, accurate, yet moderately priced. For intermittent service, to cut off all types and shapes of machineable metal. Recommended for use in the tool room, maintenance department, and machine shop.

HACK SAW Single Dry Cut	4" x 4"	No. 1	The most popular mechanical saws on the market for occasional cut-off work. Sturdily built, easy to operate, low in price, they are ideal for the small shop where speed is not essential.
	6" x 6"	No. 2	

UNIVERSAL BAND SAW



TYPE	CAPACITY	MODEL	
BAND SAW	18" x 18"	No. 8	The MARVEL No. 8 Band Saw is designed primarily for universal work. It will trim, miter, notch and cut-off bar stock, pipe, structural sections, mouldings and tubing. No other saw of any type is capable of handling the wide range of unusual cutting jobs possible on this very versatile machine.

HACK SAW BLADES—*High-Speed-Edge*

COMPOSITE UNBREAKABLE

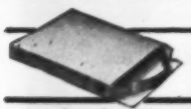
The original composite blade with a fast-cutting, long-lasting high speed steel cutting edge integrally welded to a tough, non-breakable alloy steel body. These superior blades improve the efficiency of ANY hack saw machine because they will withstand heavier feed pressure, higher tension, and faster speeds. A type and size for every hack saw, for every machineable material.

HOLE SAWS—*High-Speed-Edge*

HEAVY DUTY FOR MACHINE TOOLS

Permit sawing-out of large holes (to 4½" dia.) in steel plate (to 1¼" thickness) with small capacity machine tools and portable tools. Heavy duty arbors and 1-piece floating, self-aligning, High-Speed-Edge saws. This new type hole saw, developed by MARVEL, provides a fast, low-cost method for making large holes, an operation previously requiring much machining or large equipment.

BAND SAW BLADES



WELDED TO SIZE INDIVIDUALLY PACKAGED

Through exhaustive tests MARVEL has determined the type of set—raker or wavy—best suited for all-around cutting on every standard make and model metal band saw. These exactly suited blades come welded to size, ready for use, and individually packaged.

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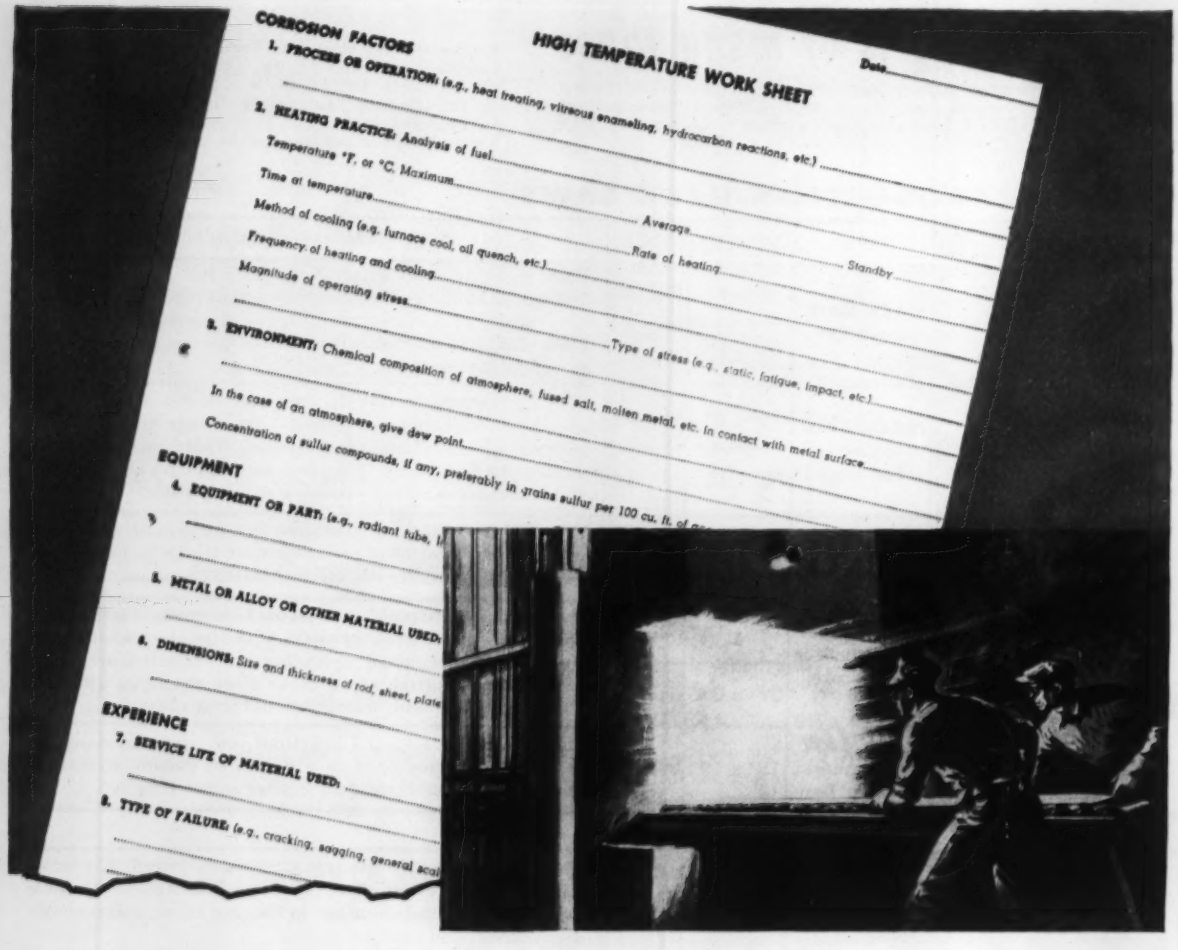
Better Machines—Better Blades


CORROSION FACTORS
HIGH TEMPERATURE WORK SHEET
Date
1. PROCESS OR OPERATION: (e.g., heat treating, vitreous enameling, hydrocarbon reactions, etc.)
2. HEATING PRACTICE: Analysis of fuel
Temperature °F. or °C. Maximum
Average
Standby
Time at temperature
Rate of heating
Method of cooling (e.g. furnace cool, oil quench, etc.)
Frequency of heating and cooling
Magnitude of operating stress
Type of stress (e.g., static, fatigue, impact, etc.)
3. ENVIRONMENT: Chemical composition of atmosphere, fused salt, molten metal, etc. in contact with metal surface
In the case of an atmosphere, give dew point
Concentration of sulfur compounds, if any, preferably in grains sulfur per 100 cu. ft. of
EQUIPMENT
4. EQUIPMENT OR PART: (e.g., radiant tube,
5. METAL OR ALLOY OR OTHER MATERIAL USED:
6. DIMENSIONS: Size and thickness of rod, sheet, plate
EXPERIENCE
7. SERVICE LIFE OF MATERIAL USED:
8. TYPE OF FAILURE: (e.g., cracking, sagging, general scal

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This World of Metals

Like the unstoppable flow of lava from a bubbling volcano, evolutionary changes are taking place in this world of metals. Industries, the men who run them and their products can't escape this dynamic onrush of progress.

Not too long ago, steel was accepted on the basis of general chemical analysis, hardness, tensile or bend tests and visual surface inspection. Specifications now call for closely controlled chemistry and grain size, guaranteed hardenability and machinability, specified impact properties, surface and internal inspection.

The expanding aluminum industry has issued new standards and introduced new grades, including some that provide high strength without heat treatment. In copper, zinc, aluminum, magnesium and other nonferrous metals, the story is the same—better materials to do a better job. New metals like titanium are pushing to get a share of the market.

Complementing the evolution in metals is the endless array of new and improved processes—vacuum metallurgy, precision heat treatment, hot and cold forming, extrusion, faster machining, casting to close tolerances and metal powders formed into a host of intricate parts.

What do these exciting changes mean to you and your company?

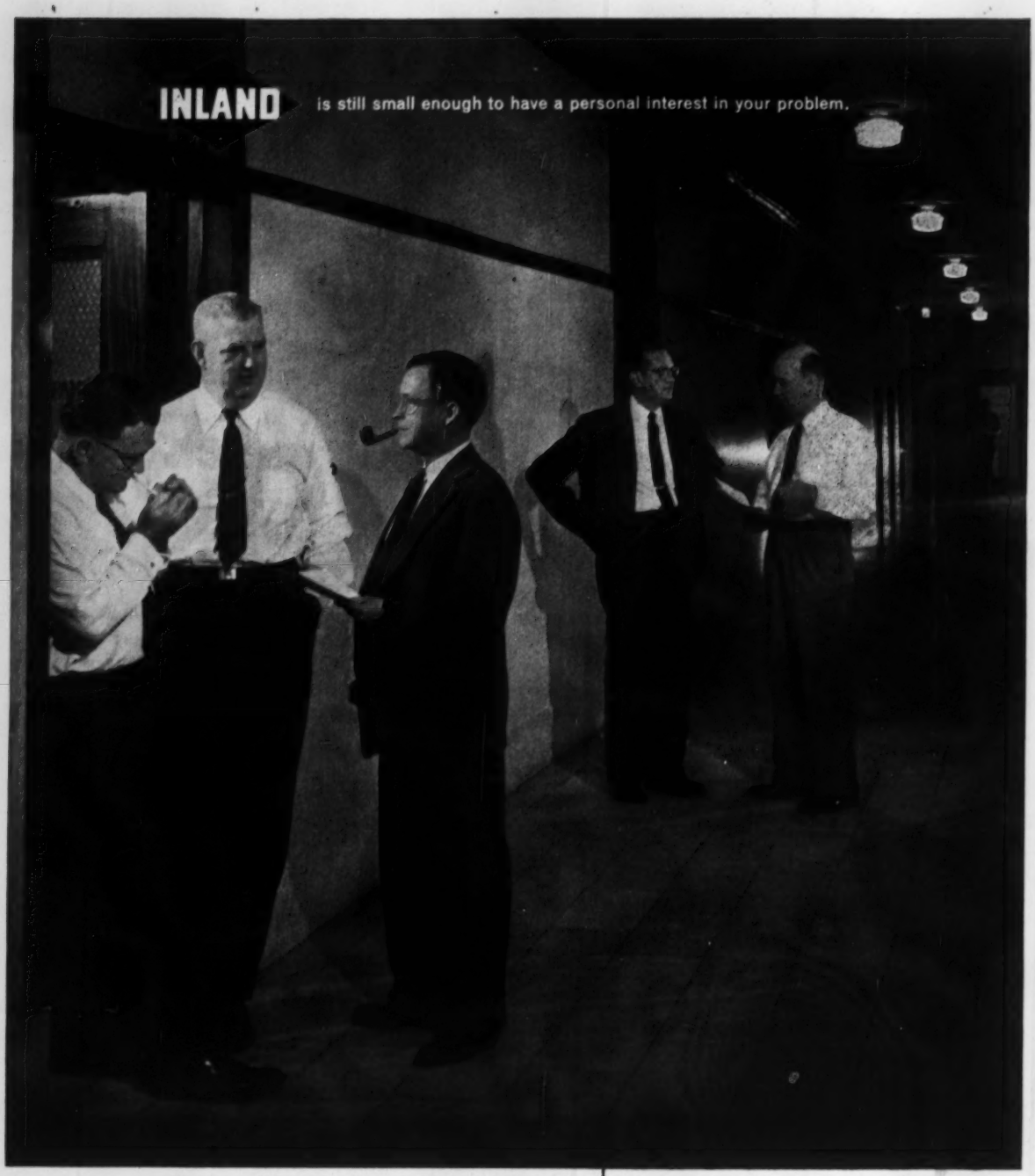
Certainly, they will help you in your day-to-day drive to make your products smaller, lighter and stronger. With attention focused on better strength-weight ratios, there's little latitude for unnecessary safety factors. Where the factor was four or five some years ago, it now is little more than one.

Even bigger areas of opportunity should not be overlooked. These changes can be so subtle that they often go unnoticed until they make their appearance in a competitor's product or process.

For management there's no job more important than keeping alert to evolutionary trends and their influence on product design. The two are inseparable from sales and profits.

Irwin H. Such

EDITOR



Why you can get quick action on steel-making questions at Inland

When your steel problem needs a prompt answer, you can get it at Inland where all the men who make decisions are quickly available. Like the top men in sales, steel manufacturing, quality control, raw materials and traffic pictured here.

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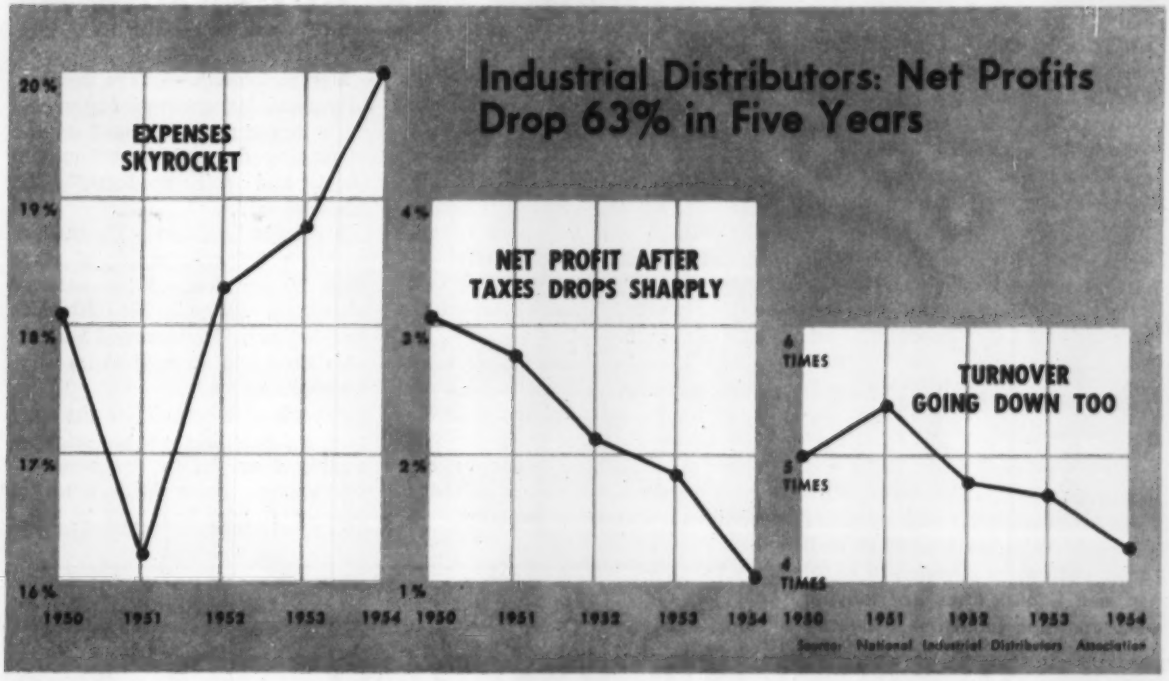
Sales Offices: Chicago • Milwaukee • St. Paul Davenport • St. Louis • Kansas City • Indianapolis Detroit • New York

Principal Products: Sheets • Strip • Structural Shapes • Plates • Bars • Tin Mill Products • Rails and Track Accessories • Coal Chemicals



Profitless Prosperity

Despite high volume, mill suppliers are worried. The above charts show why. Their problems affect metalworking because so many firms buy from and/or sell through them

SALES WILL SOAR 20 to 30 per cent this year in the mill supply industry, but you'll hear no cheers from suppliers. Continued price weaknesses in some areas, slower mill deliveries and lower profits hurt the distributor. In several regions, sales are falling well below the national average due to slowness in the predominant industries.

The new order index of the American Supply & Machinery Manufacturers' Association Inc. for the first seven months of this year ranges from 18 to 47 per cent above comparable 1954 months and surpasses every year except 1951 during those months. A seasonal decline of 13 per cent last July didn't mar bright prospects for a near-record year.

Bad News—That's the bright side of the coin. "Unfortunately, trends show that distributors' net profits dropped by 63 per cent between 1950 and 1954," reports the National Industrial Distributors' Association, Philadelphia. Gross margin and turnover dropped during those years while expenses rose steadily.

The price of mill supplies went up 5 to 10 per cent this year. In most cases increases were passed along to the customer, but there are scattered price weaknesses. "The short-inventory man cuts prices to stay in business. His competition has weakened the prices of valves and fittings," reports a Pittsburgh distributor.

Cutting Profits — "Prices on most mill supply items advanced about 8 per cent this year and should have gone higher. But for the keen competition among distributors, they would have," reports a Philadelphia supplier. Some distributors criticize manufacturers for permitting the marginal low-inventory house to handle their products. "That promotes price cutting," they say.

Lengthening mill deliveries are further hampering the distributor. Plumbing fixtures, pipe, copper products, bronze valves and some types of fasteners are in short supply.

East—The sales outlook varies across the country, depending on the status of principal industries. Eastern distributors say cutbacks in government work have caused 30 per cent declines in sales to some customers. Philadelphia suppliers say shipyard business is at low ebb, with prospects good for a pickup next year. Railroad purchasing remains low, and requirements from gear and tool and die manufacturers are only fair. Among the more active items are drills, grinding wheels, fasteners and hacksaws.

Pittsburgh — Mill suppliers report sales have increased 20 to 25 per cent from 1954 levels. Cutting tools are wearing out quickly under present production rates. Expansion of research laboratories in this area is boosting de-

mand for light machinery, too. Railroad buying is only fair, but the purchase of mine machinery is growing, together with greater demand for coal. Tool and die sales are generally improving. Steel mills, which postponed purchases during 1954 and early 1955, are buying equipment which they only dreamed about last year.

Detroit—In the Midwest, the automotive activity is credited with boosting the business of industrial distributors well above year-ago levels. "The outlook for the balance of 1955 is favorable. It should be a good year," agrees Philip C. Satterthwaite, vice president, Cogsdill Twist Drill Co., Detroit.

Chicago—Small tools, drills and files are in greatest demand, with only a few slow-moving products reported. Price weakness has ended, as 1955 sales advance 10 to 20 per cent. "All lines are moving well, and this indicates a healthy outlook," adds C. H. Paulsen, vice president, B. R. Paulsen & Co. Inc., Chicago.

Southeast—Distributors in this area report net profits are "alarmingly low," but they are optimistic about sales. "We find a cheerful attitude among our consumers of industrial supplies, machinery and equipment," reports Paul J. Stine, president, Harry P. Leu Inc., Orlando, Fla.

West—Aircraft orders are contributing to generally high sales. Prices are stabilizing. Pacific region industrial supply sales were 20 per cent higher in the first seven months of 1955 than in the corresponding months of 1954, western distributors report. "We are confident that sales of industrial supplies during the fourth quarter of 1955 will equal or exceed those for the previous quarters of the year," says C. E. Gollwitzer, manager, Pratt-Gilbert Hardware Co., Phoenix, Ariz.

Hard Selling — The large-city distributor, faced with an increasingly competitive situation, is bolstering his sales force. "We are adding specialists who can pinpoint our sales to specific industries," explains T. H. Hubbard, vice president and sales manager, Harris Pump & Supply Co., Pittsburgh.

With additional Ravenswood facilities, Kaiser is . . .

Expanding the Expansion

KAISER ALUMINUM & Chemical Corp., Oakland, Calif., will start a $90-million expansion program when it completes financing details.

Major emphasis centers on the Ravenswood, W. Va., plant where $75 million will be spent to enlarge and complete a fully integrated sheet and foil rolling mill by early 1957. Annual capacity: 33.5 million lb.

D. A. Rhoades, Kaiser Aluminum's vice president and general manager, emphasized that the program is separate from the corporation's recently considered plans to expand bauxite, alumina and primary aluminum reduction capacity.

Market Growth — "The decision to expand Ravenswood faster and on a larger scale is based on the increasing demand for aluminum sheet and foil products," Mr. Rhoades said.

Strategic Location—"Centralized within a 500-mile radius of more than 70 per cent of the nation's aluminum usage," Mr. Rhoades pointed out. "Ravenswood will enable Kaiser to strengthen its service position.

"It will also consolidate the company's direct line raw material assembly flow in its ore-to-market operations. Some 5000 miles of current freight haul will be elim-

Kaiser Aluminum's Ravenswood, W. Va., rolling mill is on a 2500-acre site on the Ohio river. It is within 48-hour truck or rail shipping distance from most major aluminum users. Raw material flow: Jamaica bauxite mines to the Baton Rouge, La., alumina plant; from there to the Chalmette, La., reduction plant; then up to Ravenswood

inated. Freight costs on this will be reduced 69 per cent."

Equipment Orders—United Engineering & Foundry Co., Pittsburgh, is building a 168-in., hot reversing mill and a 100-in., 5-stand, 4-high, continuous hot mill for the Ravenswood plant.

Lewis Foundry Division of Blaw-Knox Co., Pittsburgh, has a contract calling for two 4-high cold mills, a 72-in., 2-stand tandem mill and a single stand mill.

Loewy-Hydropress Inc., New York, is building a 110-in., hot reversing mill. Total orders: Over $21 million.

Also to be installed is a 72-in. wide foil mill. Direct chill casting facilities will produce rolling ingots up to 10,000 lb, largest ever used in the aluminum industry.

Other Plant Expansion — Increase in annual capacity of the Halethorpe, Md., extrusion plant from 24 to 46 million lb; increase of 12.6 million lb of primary aluminum capacity at Mead and Tacoma (Wash.) reduction plants; installation of a cryolite recovery plant for direct chill casting of billets at the Chalmette, La., plant.

Financing—Public sale of a new series of 4¾-per cent preferred stock will bring in about $35 million of the expansion funds. The rest will come through the sale of $40 million of 3¾-per cent first mortgage bonds and rescheduling of payments on present bank loans.

U.S. Steel Offers Plastic Pipe

National Tube Division, U. S. Steel Corp., has introduced its second type of plastic pipe. Made of polyvinyl chloride, it is known as PVC. The division came out with polyethylene pipe earlier this year.

H. J. Wallace, vice president-sales at National Tube, says the new pipe is excellent for sour crude oil pipe lines, salt water disposal lines, chemical plant piping, industrial cold water lines and vent pipes. PVC resists attack by acids, alkalies, salt solutions, alcohols and most chemicals.

The new product is being handled by steel pipe distributors throughout the country. Sizes range from ½ to 6 in. Light weight makes installation easy.

Loading leaf springs at Maremont Mfg. Corp., Bayamon, P. R.

Opportunity in Puerto Rico

LOOKING FOR a Shangri-La plant site where there are no taxes and abundant labor?

Maremont Automotive Products Inc., Chicago, found it when the company located a leaf spring plant in Puerto Rico. The venture was so successful that it's now building a second 11,000-sq ft factory for rebuilding and reconstructing automotive clutch assemblies.

Why Puerto Rico?—Maremont Mfg. Corp., according to its president, J. Theodore Wolfson, was set up in 1953 at Bayamon (a San Juan suburb) "to take advantage of Puerto Rico's unique tax and labor situation."

"Location was another big answer," says Mr. Wolfson. "The island is a perfect center from which to serve Maremont's more than 300 customers scattered throughout 67 countries in South America, Europe, Africa and Asia."

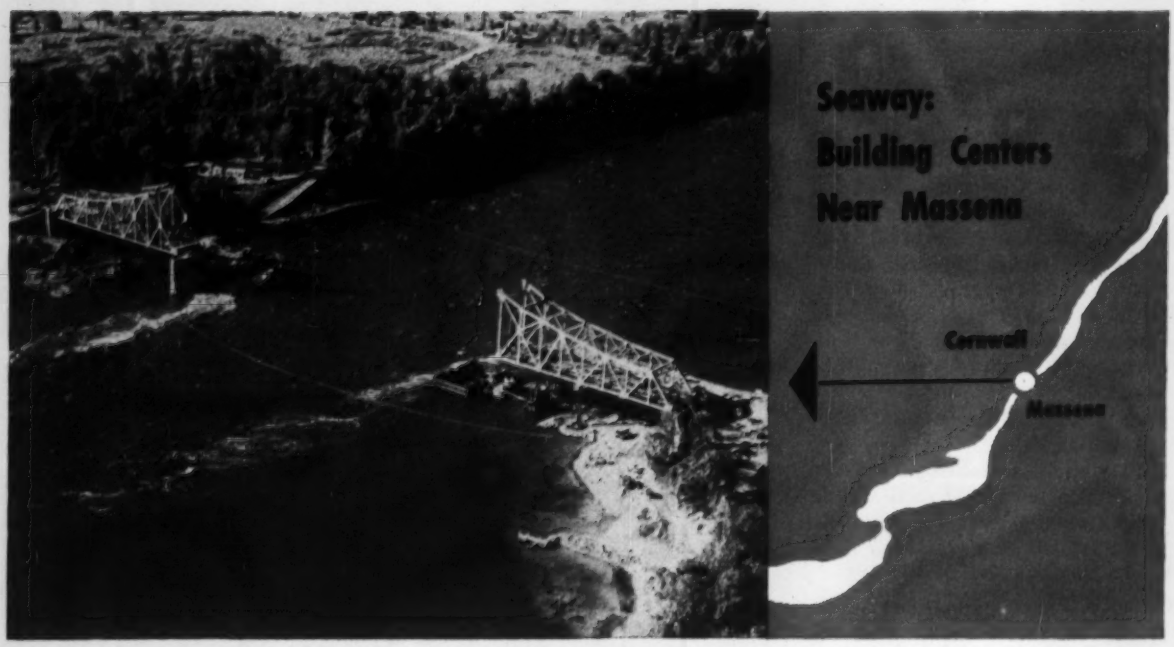
Other Advantages—As a U. S. territory, Puerto Rico has no immigration, tariff or exchange barriers. Because the island has no Congressional vote, federal taxes do not apply.

In addition, Maremont and other mainland affiliates get a 100 per cent local tax exemption for ten years under the Industrial Incentives Act of 1954. Taxation and labor advantages outweigh the usually increased transportation costs to and from the mainland.

Labor—"Puerto Ricans," says Mr. Wolfson, "possess an unusually high degree of manual dexterity, but they need careful training to shift to factory manufacture."

Two methods were used: Workers and technicians were sent to Maremont's U. S. plants for on-the-job training, largely at the Puerto Rican government's expense. Others got special courses through the University of Puerto Rico's vocational work program.

Opportunity—In the last two years, some 29 mainland-affiliated metal product plants have followed Maremont's lead. Newest and biggest is Gulf Steel & Wire Co., affiliate of Fanner Mfg. Co., Cleveland. Its 135,000-sq ft mill was built by Puerto Rico Industrial Development Co., a government agency which constructs and leases one-story factory buildings for as low as 40 cents a square foot.



Bridge steel for the power house access road goes up as . . .

St. Lawrence Seaway Takes Shape

BY 1960, the United States and Canada will have run up a combined bill of more than $900 million for the St. Lawrence Seaway and power project. More than $700 million of this is being poured into a 15-mile stretch of the St. Lawrence river just north of Massena, N. Y., where the Barnhart island power plant is going up.

Work on the $600-million power project started in August, 1954. The Boston engineering firm in charge of the American end reports that 93 contracts worth about $114 million have been let. Similar progress is being made by the Canadians. Altogether, some 4400 men are at work. In 1957, when construction will peak, there will be more than 11,000. The power station will be completed by 1959.

Pleasant Surprise—Bidding has been keenly competitive. Many jobs, says one official, have been let well below estimated figures. Adds the New York Department of Commerce: "Employment is less than originally anticipated, largely because of the extensive use of heavy equipment." Some $35 million in construction machinery already is working.

The seaway itself is not scheduled for completion before 1960. It was April before ground was broken on the American portion. Six prime contracts have been let, including all excavation work in the Massena area. The 10-mile-long Sault canal and its two locks are about 15 per cent dug out. Bids for the locks will be opened early next year. They will be ready for 27-ft shipping by the spring of 1959.

Lion's Share—The initial cost of the seaway will be $300 million, of which Canada will spend about $195 million on deepening the Welland canal and building five new locks. Between them, the U. S. and Canada have some 1500 men working on this end of the project. In the peak construction year, there will be about 5000.

By 1959, the project will start to repay some of its cost. The power plant will be the second largest in the world (Grand Coulee dam rates first). Its theoretical capacity is almost 1.9 million kw. It will have a steady output of 1.4 million kw. The new waterways will handle ore carriers of 25,000 tons capacity, ten times the present limit. Between 1965 and 1970, shipments through the seaway are expected to jump to 52 million tons a year, five times as much as was cleared in 1953.

And 1960 won't see the end of development in the St. Lawrence region. The initial cost of the seaway itself may mount into billions, as connecting harbors, channels and port facilities are built and dredged and new industry comes in.

More Start Apprenticeship

The number of apprentices rose 4015 during the first six months of this year. The Department of Labor says 162,690 apprentices were in training at mid-year.

Biggest increases were in the construction industry, says W. F. Patterson, director of the Bureau of Apprenticeship.

Booming auto production calls the signals as . . .

Diecasters Eye Record Year

TALK ABOUT growth industries: Diecasting sales this year will hit about $415 million, almost 30 per cent more than the previous best year, 1953. To rack up those billings, the 400-odd independent diecasters will melt 375,000 tons of zinc and 390 million lb of aluminum.

The spectacular gain is all the more impressive in view of the nose dive sales took during the 1954 slump (see chart).

Buyers—Largest user of job shop diecastings is the auto industry, supplementing big volume by captive affiliates. Next are home appliances, machinery and tools.

Armed with improved die materials and melting practices, broader use of metals and "lower your costs" ammunition, diecasters are making steady progress in establishing new applications for their products. They include diversified uses like: Typewriter frames, street light reflectors, new aircraft and automobile air conditioner components, lawnmower frames, electronic parts and builders' hardware.

Application—The aluminum one-piece stator used in automobile torque converters is a good example of cost cutting. Before the piece was designed to be mass produced by diecasting, each blade had to be individually machined and assembled to the hub by hand, too costly a process for lower-priced car installation.

The early bugaboo of size limitations no longer holds. The auto industry is diecasting grilles and door frames; experiments are progressing with equipment for diecasting engine blocks. The goal: To take advantage of diecasting's low per-piece labor cost.

Future—Since 1946 the use of zinc diecastings has increased an average of 8.8 per cent a year, despite the dip in 1954. Aluminum, since 1948, boasts an average annual growth of 28 per cent. Confident that those gains will continue, the American Die Casting Institute estimates that by 1960 requirements will be a minimum of 500,000 tons of zinc and 800 million lb of aluminum. Gains are also seen for magnesium, copper-base alloys and other higher melting point materials, owing to improvement in die metal and die lubricants.

Automotive outturn could fall off moderately in 1956 and still require more diecastings; more are being used per car. The increase would favor the light metal. Zinc diecastings are tied more closely to production (grilles, door handles, etc.), while use of aluminum is broadening from year to year.

Headaches—Despite growing acceptance of their product, diecasters have their troubles. Aluminum supply is one, with secondary smelter tonnage accounting for close to 85 per cent of requirements. Aluminum has not eased since diecasters asked for relief from the government's stockpile earlier this year. A halt in stockpiling for at least one quarter and restrictions on the export of aluminum scrap would help supply, at least temporarily, in the opinion of most diecasters.

Enough zinc is in sight, but fluctuating prices command strict attention in estimating diecasting costs for forward delivery. Consideration is being given to price estimates based on the average special-high-grade zinc cost in the previous quarter.

Diecasting Sales

(millions of dollars)

1955	$415
1954	270
1953	325*

*Previous high year

Read Prentice Corp.

Worker puts a polish on a large casting inside a special room

Shotblasting Sales Shine

SHOTBLASTING equipment is going great guns this year. "Industry sales are running 75 per cent ahead of 1954 and 35 per cent ahead of 1953." That's how E. A. Rich, general sales manager of Wheelabrator Corp., Mishawaka, Ind., paints the picture.

Wheelabrator and Pangborn Corp., Hagerstown, Md., have the lion's share of the business. About a dozen makers are in the field.

Trend—The leaders are promoting the enclosed cabinet machine. Work is mounted in a fixture and continuous loading arrangements can be provided. Most machines depend on centrifugal force to hurl shot from a rotating wheel, though air blast units are made.

The other major type of shotblasting equipment (see photo) is still going well. Says D. E. Neustadt, sales manager of W. W. Sly Mfg. Co., Cleveland: "This equipment has the advantage of complete flexibility. You can blast work as big as the room."

New Look — The main function of shotblasting is to clean or deburr parts. But increasing interest is being shown in shot peening, where cleaning is secondary to improving the physical properties of the work. Automobile springs have been shot peened for quite some time. The aircraft industry (see STEEL, May 23, p. 102) is adopting it.

Vacu-Blast Co., Belmont, Calif., notes: "The Navy now specifies shot peening for ship propulsion gears." Vacu-Blast's sales volume runs about $1.5 million a year. It will be up 50 per cent this year over 1954. The company hopes to make a similar gain next year.

Design Problem—Other makers share this optimism. One of the oddities of the shotblasting business has been the design problem presented by a machine that consumes itself. It has been licked by hard-wearing alloys in the machines and the development of cast steel shot as the abrasive.

All makers rely on a double-edged sales spur: Savings in labor and cleaning costs. They cite labor savings as high as 400 per cent, the trimming of cleaning costs to one-fifth of what they were.

ODM Sets Goals

Expansion for defense goes on but rules for fast write off of taxes are tightened up

ARTHUR S. FLEMMING, director of defense mobilization, has acted on the 38 industry expansion goals that were suspended Aug. 11. He reopened 11, closed 26. Only taconite remains on the suspended list.

The goals set the top limit for which the government will allow industry fast tax write-offs. Of the reopened goals, ten were revised. Here are some of the new ones:

Commercial aircraft—900 planes —orders must be placed by the end of the year.

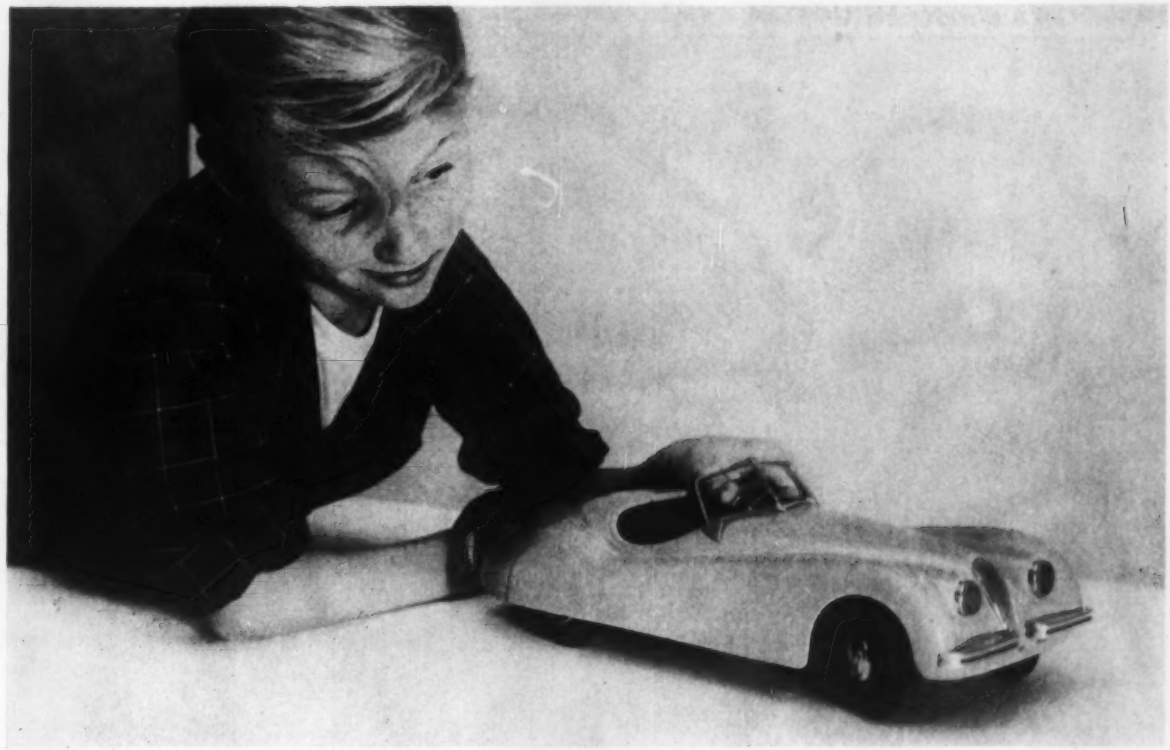
Domestic petroleum—A refining capacity of 9 million barrels a day by Jan. 1, 1957.

Rutile expansion — 35,000 tons due Dec. 31, 1955.

Manganese ore—Target date has been extended to the end of the year.

The freight car goal will cover cars for which construction is started, or orders placed, by Dec. 31, 1955.

Closed Goals — Among the 26 closed goals are: Antimony, bauxite, cobalt, by-product coke, synthetic cryolite, electrolytic tin plate, large gray iron castings, iron ore, diesel locomotives, oil pipe lines and storage facilities, ore carriers, railroad passenger cars and titanium. The closing of aluminum and most steel goals was reported in STEEL, Oct. 3, p. 41.



Chas. Wm. Doepke Mfg. Co.

A $1-billion retail sales year in '54 set the pace as . . .

Toymakers Go for Another Record Year

IMAGINATION, alertness to merchandising procedures and continuing growth in population will bring another banner year to the toy industry.

Sales last year passed the $1 billion mark (retail level) for the first time. Prediction for this year: Look for them to rise another 10 per cent. Manufacturers' total sales were over $500 million in '54 and should rise to $550 million this year.

Metal Statistics—Manufacturers' sales of metal toys will rise to some $230 million this year which compares with $210 million in 1954 and $180 million in 1953. Into these metal toys, explain industry spokesmen, go some 225,000 tons of steel—mostly light gage sheets, strip and spring wire. More aluminum will be used this year, too, but applications will be small when compared with the amount of steel used.

Toy producers are reaching their annual production peak as 70 to 75 per cent of all the toys manufactured in the U. S. are sold at Christmas time. Peak sales period for manufacturers is in March —the time of the annual trade show sponsored by Toy Manufacturers of USA Inc.

Who Buys?—A survey conducted for the toy industry by Opinion Research Corp. indicates that 33 million families spent an average of $28 for toys during the 1954 Christmas season. On this basis, the survey's suggestion that the toy business last year may have approached $1.25 billion (at retail level) seems within reason.

Major market: Toys for the two to six year olders. Half the toys purchased and half the dollars spent are in this group. About a quarter of the toys (and a quarter of the retail dollars spent) are in the seven-to-ten-year age bracket. Older children (11 to 14) account for only 9 per cent of the toys sold and 13 per cent of the retail dollars.

While the toy business has expanded, the number of manufacturers has remained about constant. Out of 2000 producers, 1200 get 95 to 98 per cent of the industry's business.

Imports Grow—With the duty on toys from Japan reduced 50 per cent since Sept. 10, imports will increase over last year's total of $15.8 million (including $2.9 million in metal toys). Totals for the first seven months of this year already are ahead of the corresponding period for '54 by some $1.9 million. Japan and West Germany continue to be the leading toy exporters to America.

If sales continue at present levels, some 2000 toy manufacturers will receive a big Christmas present—another record year.

By E. C. KREUTZBERG *Washington Editor*

Small businessmen don't like the fine print as . . .

SBA Loan Program Lags

DISSATISFACTION with the loan policy of the Small Business Administration is causing more and more small firms to boycott the organization.

Cause of the Trouble — When a borrower's application is under discussion, he is not told about certain restrictive conditions he must accept before he gets the money.

Informed parties say that about 40 per cent of potential borrowers refuse to accept the conditions, and the deal falls through.

Case History — One authorization a proposed borrower could not stomach contained 23 stipulations which were inserted by regional office attorneys.

On appeal to SBA lawyers in Washington, 16 of the 23 stipulations were deleted, but the remaining seven were so objectionable that the borrower declined to accept the money.

The Fast Break—One of the most objectionable SBA stipulations is not sprung on borrowers until their loan applications have been approved. It is called the "After-Acquired Property Agreement." This clause binds a borrower to add to the collateral, which he put up, all property and assets he later acquires.

"Disbursement of the Loan" is another amazing clause which forces a borrower to get regional SBA permission before he can use any of his loan money—no matter how well secured by collateral.

Other stipulations call for the signature of the borrower's wife, freezing of officers' salaries during life of the loan, etc.

No Good Reason — There also have been nasty instances where small business loan applications have been turned down without adequate reason.

The transcript of testimony taken in March, 1955, by the Multer subcommittee of the House Small Business Committee cited the turndown of the Triest Mfg. Works, Annapolis, Md.

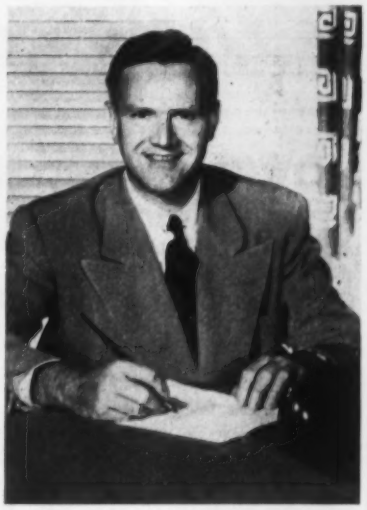
Organized to produce a new pipe wrench called Stilsomatic, Triest's $65,000 loan application was turned down three times by the SBA despite the fact that Farmers National Bank of Annapolis agreed to participate to the extent of 35 per cent. Triest had assigned government contracts worth $543,579 as collateral.

Signs of the Times—Meanwhile, it looks like SBA is in for some sort of investigation in the near future.

Wright Patman, chairman, House Small Business Committee, makes no bones about his dissatisfaction with the way SBA functions. In a recent report, Mr. Patman said: "SBA has received loan inquiries from small businessmen at an average of better than 11,000 per month.

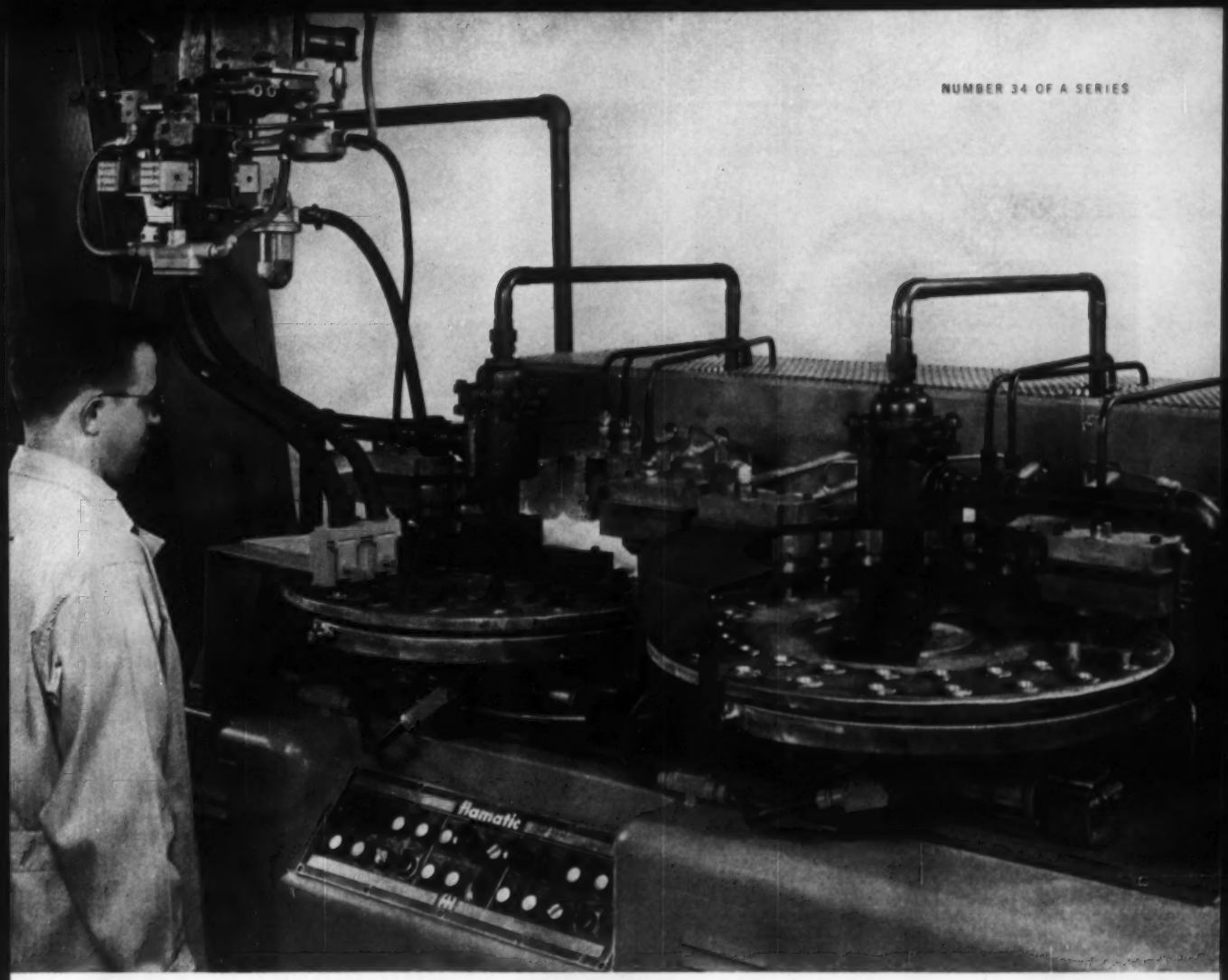
"In its entire 21 months of operation, however, just 5085 of these inquiries successfully passed SBA's screening tests and became formal loan applications. Of these few, SBA approved 1141.

"Only 395 of these approved applications were for direct loans which involve no bank participation. SBA actually made disbursements to 276 of these."



Meet C. F. Ogden: He's the new assistant director, materials, Office of Defense Mobilization.

Mr. Ogden is on leave from the Detroit Edison Co., where he is manager of purchases. He will advise ODM Director Arthur S. Flemming on the quantity of materials required to meet the nation's defense and stockpile needs, materials expansion and procurement programs for mobilization. He may be contacted in Washington by calling Sterling 3-5200, Ext. 3313.

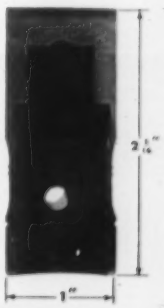


fully automated flamatic hardens 3600 parts/hour continuously

3600 hydraulic valve lifters per hour are continuously conveyed from a hopper to "carousel" type fixtures on this Cincinnati Flamatic hardening machine. The carousels index automatically after each heating cycle to bring a new pair of parts into position. Each lifter is selectively hardened to RC 57-61, to a 3/32" depth, and dropped into the oil quench. This is another demonstration that Cincinnati Flamatic engineers can match unusually high production rates and tight heating specifications by combining standard components with ingenious tooling.

Control cabinet, quench tank, and conveyor are standard, hopper-fed[1] loading mechanism, turntables, and flame heads are special.

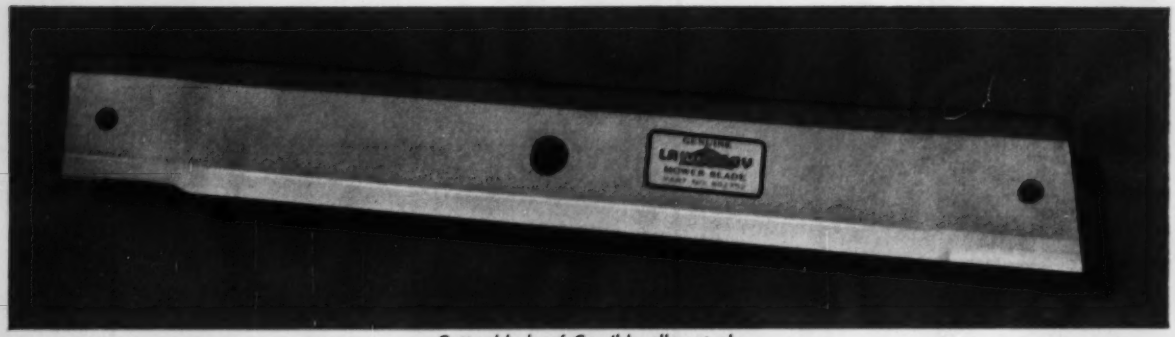
Look into Flamatic-hardening as a new approach to your heat treating problems. Bulletin No. 1861-M gives a wealth of good examples.



cross-section showing hardness pattern

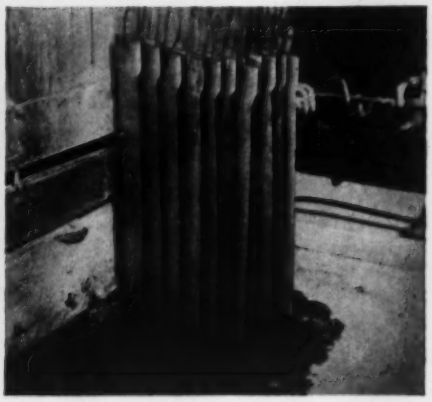
CINCINNATI **flamatic**

PROCESS MACHINERY DIVISION
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U.S.A.



Cutter blade of Crucible alloy steel.

First step in manufacture of cutter blade. Crucible beveled blade alloy steel is fed through this 100-ton press, where it is cut to length and holes punched.



Next, lengths are formed to shape on a hydraulic press, and then given a tempering bath as shown.

CRUCIBLE ALLOY STEEL *cuts blade damage in rotary mowers . . .*

Lawn-Boy mower. Built by RPM Manufacturing Co., Lamar, Mo., a subsidiary of Outboard, Marine & Manufacturing Company, maker of Johnson & Evinrude outboard motors.

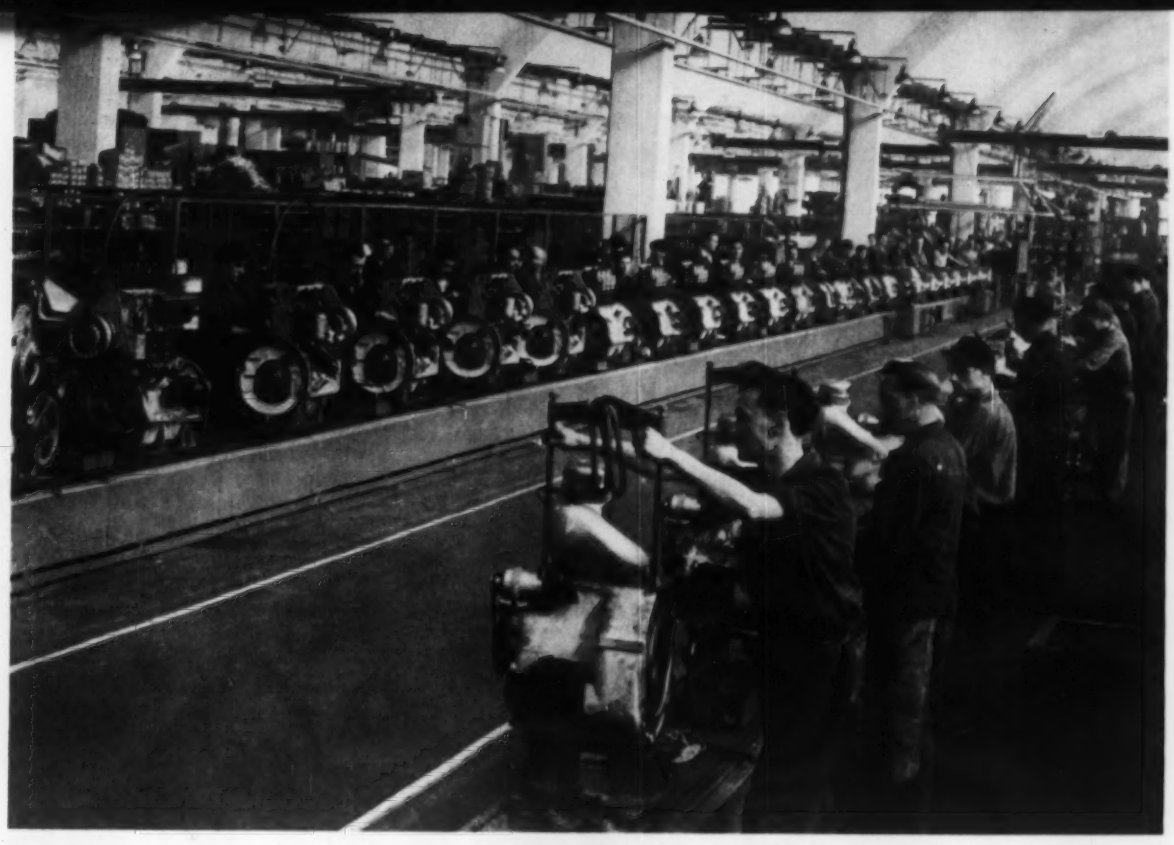
Rotary lawnmower cutter blades, whirling at high speeds, often hit small rocks or bits of trash. Ordinary steels just can't take that sort of rugged treatment. They chip, crack – wear out far too quickly. That's why in leading mowers, like the new *Lawn-Boy*, you'll find special *alloy* steel cutter blades *designed for reliable performance.*

For Crucible has developed a *special alloy steel* made to give the best possible combination of toughness and hardness for long-lasting edges—and formability and ductility for ease of manufacture. It's been so successful that *Crucible is now the largest producer of lawnmower steels.*

Most Crucible steels are designed to fill *special* needs. If you have an application where ordinary steels won't do, come to Crucible. Take advantage, too, of the dozens of technical booklets and data sheets Crucible has prepared to help you make the best use of special steels. For a free publication catalog, write *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America



Klockner-Humboldt-Deutz assembles air-cooled diesel engines with 1 to 12 cylinders from standardized parts at its Cologne plant

West German industry makes plans for becoming . . .

Workshop of the World

"GERMANY has always been the workshop of Europe; now it should become the workshop of the world."

That statement by a prominent German pretty much reflects the economic planning and objectives of the Federal Republic today.

Out for Business — German industry is establishing sales agencies and branch plants around the world, including areas previously dominated by Great Britain and the U. S. Plenty of opportunity also is seen for more business in the U. S. for such items as toys, scientific instruments, cutlery and autos. Where German firms can't compete for direct sales, they're setting up licensing arrangements. As yet, the Germans are not going all out to combat American mass production methods and high wages. They're competing where the labor content of an individually produced item is high.

Federal Minister of Economics Ludwig Erhard is fighting for freer world trade and convertibility of currencies—all part of the conviction that Germany cannot live alone. More business abroad means more for the people at home. Two years ago only one of 55 Germans had a car. Now there's one for every 34.

More Consumer Goods — Four hundred television sets were made in 1951. Last year, production was up to 200,000, and it's expected to be 3 million in a year or two. Radio production already is up to 3 million. Production of other consumer durables like refrigerators and washing machines this year is double that for 1954.

Prices on industrial and consumer goods are tending down currently but are about double 1937 levels. Exceptions are prices on mass-produced items like radios and fractional horsepower motors that are about the same as prewar.

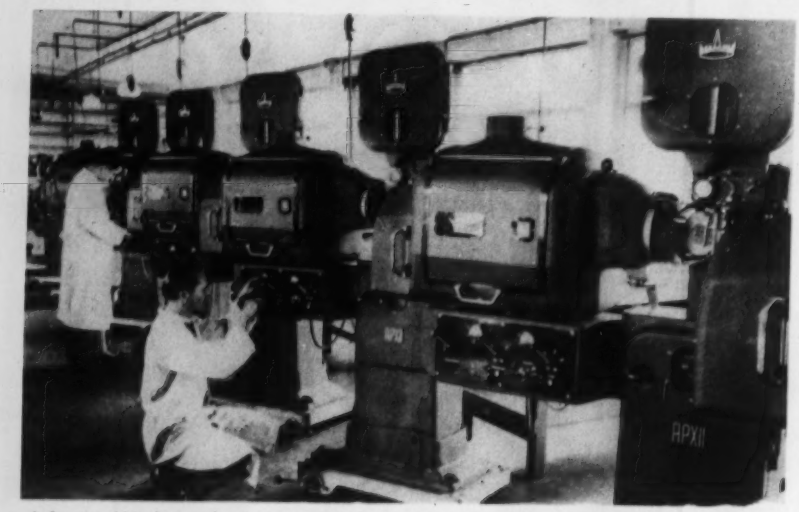
Job Shops—The German "workshop" can be likened to job shops in America. A good example is Machinenfabrik Augsburg-Nurnberg A. G. that engineers and builds a score of products, ranging from small printing presses to conveyors, bridges, diesel engines, gas holders, steam turbines, railroad cars, busses and trucks.

Its Nuremberg plant was 85 per cent destroyed in the war, but bombs missed the building where 40-ton Panther tanks were being assembled, and the last one was delivered two days before the Americans arrived. In that same building, heavy trucks are rolling out at the rate of 350 a month.

A new 42-ton truck (with trailer) has an 8-cylinder "noiseless" engine that burns gasoline, kerosene, gas-oil diesel fuel, jet fuel or even light engine oil. It develops 155 hp at 2000 rpm and has a compression ratio of 17 to 1.

Quietness is attributed to a new direct fuel injection system and

At Hamburg, another locomotive is on the way to a good customer like India or South Africa. Of $60 million locomotitve output, 70 per cent is exported



Askania Werke's plant in West Berlin makes movie projectors and scientific instruments. Stripped by the Russians, it now is back, employing 1300

AEG's Max Nippold (left) and Friedrich Mortzsch (right) tell Editor Irwin Such about sales plans as German Press Chief Paul Weber (standing) looks on

improved piston design. MAN plans to license a U. S. company. The French also are interested.

MAN engineers say they have developed a diesel with the lowest fuel consumption in the world. Thermal efficiency is 45 per cent, versus 38 per cent previously. A new locomotive engine has thermal efficiency of 42 per cent.

The latest marine diesel is a 4-cycle, 16-cylinder, 3500-hp job developed for the U. S. Navy. Baldwin-Lima-Hamilton is the MAN licensee. Beginning in 1956, MAN will build marine engines and steam turbines at Hamburg.

MAN has offices in New York to contact engineering firms and contractors with orders in other countries.

Best Customer, India — Before the war, Managing Director Paul H. von Mitterwallner of Krauss-Maffei A. B., Munich, would feel elated over an order for 20 to 25 locomotives. Since the war, orders are much bigger. His company has booked 350 steam locomotives for India, his best customer, and also has an advisory contract with Indian railroads.

In 1922, the company started making welded locomotive frames and now is building them up to 4000 hp by this method. K-M works with Siemens and AEG in building electric locomotives.

For variety, K-M makes paper mill, plate glass, flour mill and packing house equipment, and has a jobbing business in iron and steel castings.

Tailor-made Plants — Dr. Walter F. Vogeno of Glockner-Humboldt-Deutz A. G.'s Humboldt Division thinks that in setting up a production process, planning, engineering and construction should be combined in one organization.

Humboldt, for instance, has built a tailor-made electrolytic zinc plant in Austria, a cement plant in Evansville, Ind., and an experimental low-shaft blast furnace for making pig iron.

Air-cooled Diesels — Franz W. Dickel expects the Deutz division will make 45,000 diesel engines this year (more than any company in the world). He says that figure compares with 40,000 last year and General Motors' production of about 36,000.

Using standardized parts and assembly line methods, Deutz builds air-cooled diesels with 1, 2, 3, 4, 5 or 6 cylinders in line and V-types with 6, 8 and 12 cylinders.

The air-cooled engines are going into Deutz farm tractors, Magirus trucks and industrial equipment. Deutz engines are running irrigation pumps in the U. S. and are replacing some gas engines in trucks.

Deutz developed the air-cooled type during the war, and Herr Dickel expects to license an engine builder in the U. S.

Lightweight Trains — For 100 years, Linke-Hoffman-Busch built railroad cars in Breslau. When the Russians took over, L-H-B moved to Salzgitter where its 2600 workers produce eight freight cars a day and 14 passenger cars a month.

L-H-B hired an aircraft designer formerly with Focke-Wolf to reduce car weight. A seven-unit articulated train for German railroads weighs 100 metric tons and hauls 130 passengers with a 600-hp engine. A conventional train with the same capacity weighs 190 tons and needs 1200 hp. The cars have cylindrical bodies like an airplane, with longitudinal supporting members welded to the skin.

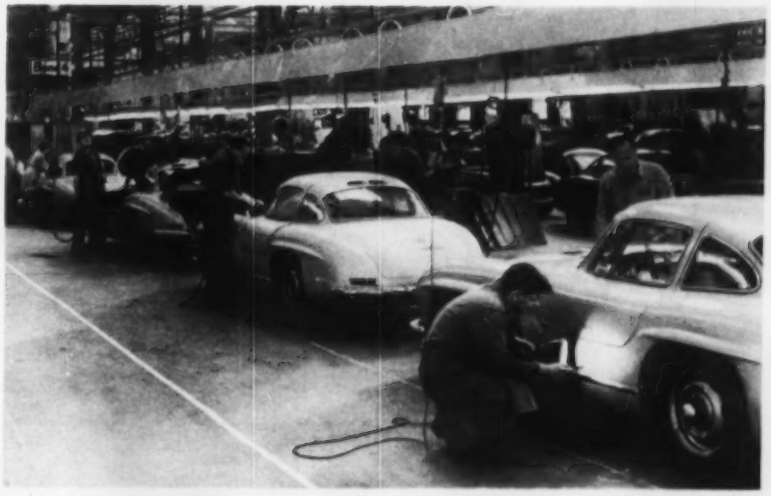
Weight in American-type cars for Chile has been reduced from 42 tons to 31 tons. For short hauls in Germany, light rail-busses are popular.

Auto Trends—German engineering advancements in automotive engineering like Daimler-Benz unit body and frame construction and free-swinging rear axles for better roadability are reported influencing American designs for 1957 and 1958.

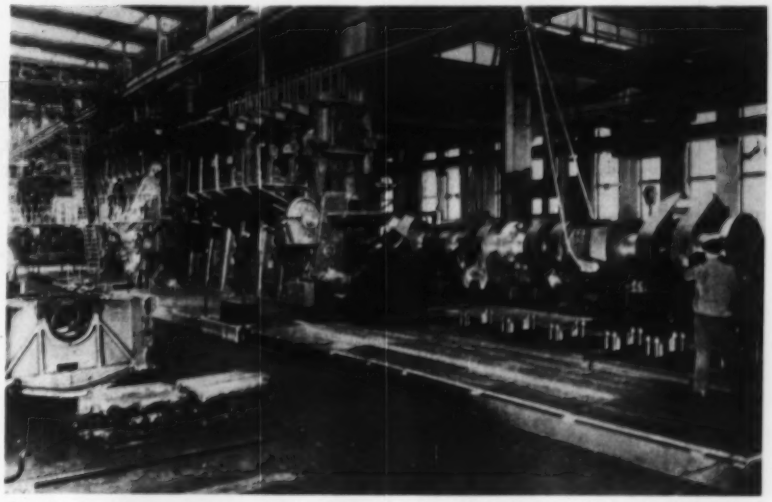
Economies are seen in direct fuel injection, but U. S. engineers still favor the conventional carburetor.

Pumps — Pleuger Unterwasserpumpen, Hamburg, has developed deep-well, squirrel-cage, electric-motor-driven pumps for both water and oil in sizes up to 1500 hp.

Sixty per cent of Pleuger's production is exported, with the U. S. the No. 1 market, Australia, the No. 2. Director H. Knirsch says conversations have been held with representatives of the Byron Jackson Co. for American production rights.



Daimler-Benz turns out nine sports cars daily at Sindelfingen, Germany. Most of them are headed for America, where the firm plans to set up a plant



Working with Baldwin-Lima-Hamilton, Machinenfabrik Augsburg-Nurnberg has built 3500-hp diesel for U. S. Navy, weighing a sixth as much as usual type

Electrical Equipment — Allgemeine Elektrizitats - Gesellschaft was closely associated with General Electric Co. until World War II, and the two companies still are good friends. AEG makes practically everything from small household appliances to steam turbines for central power stations.

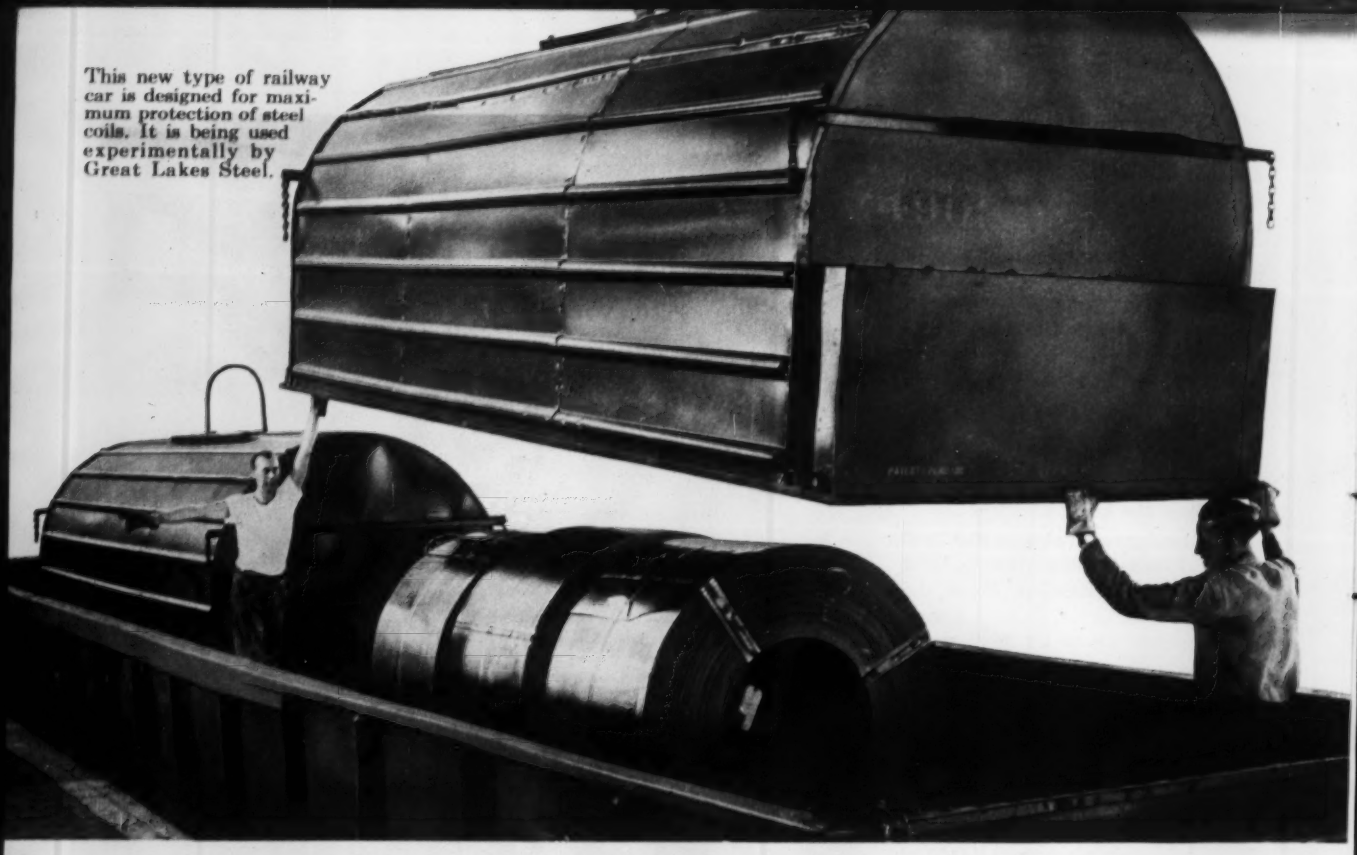
AEG sales this year will be about 750 million DM. Its affiliates, including Telefunken, will do another 750 million.

AEG's chief competitor is Siemens and to a lesser extent Brown-Boveri and Bosch. Exports amount to about 18 per cent of total sales. Austria is proving to be a good market. In South America, AEG is making more headway with its industrial lines than with domestic appliances.

Defense — Most German industrialists agree with Director Karl Weiss of MAN who says: "We want to have as little to do with defense as possible, but we expect that we will have to engage in it."

Report on Europe

Back from a six-week tour of West Europe, STEEL's editor, Irwin H. Such, reports his findings in this article, the sixth of a series.

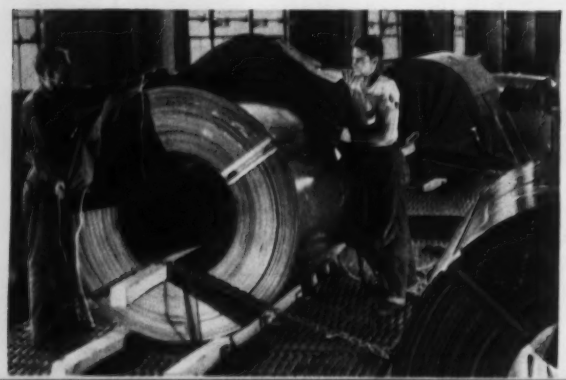


This new type of railway car is designed for maximum protection of steel coils. It is being used experimentally by Great Lakes Steel.

How Great Lakes Steel *delivers* quality

Another order receives individual attention as sheets of steel are wrapped with a waterproof covering and banded to meet the customer s specifications.

Steel coils (below) are securely blocked on a truck and trailer at Great Lakes Steel. Heavy tarpaulin cover is provided by truckers as standard equipment for additional protection.



The emphasis on quality at every stage of production at Great Lakes Steel extends right on through to the Delivery Department. There, careful attention is given to handling and packaging each coil and bundle to make sure that the customer receives his order in prime condition.

The Delivery Department has another important responsibility, too. It must see that our products reach each customer in ample time to meet his production schedules.

For quality with service—that extends all the way from the beginning of our operations to the end of yours—call on Great Lakes for your flat-rolled steel requirements.

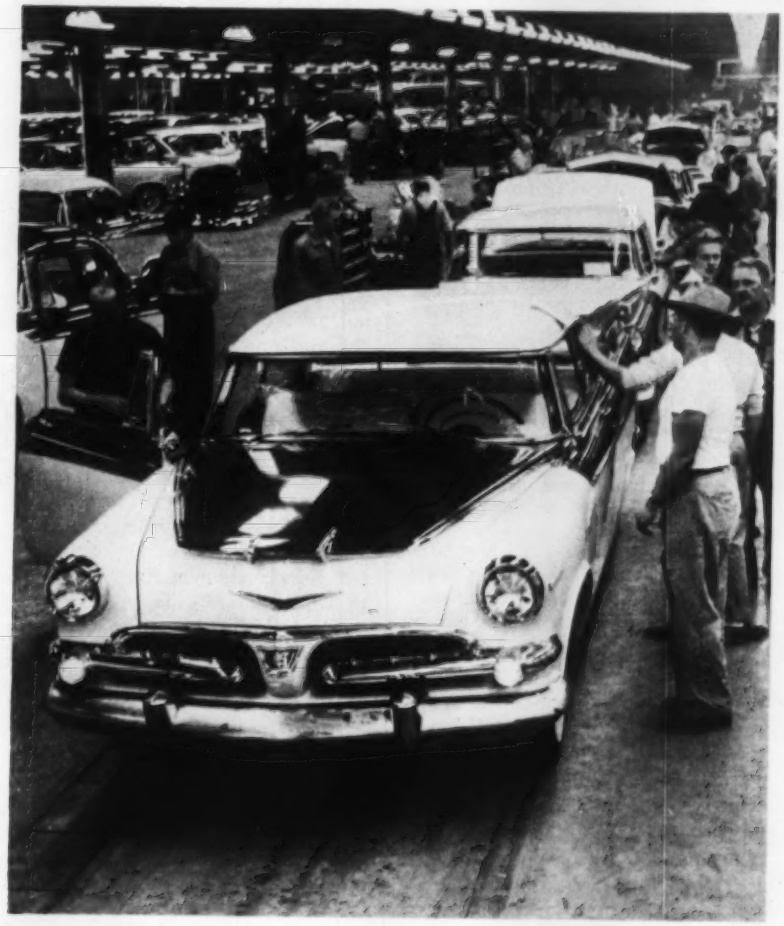
GREAT LAKES STEEL CORPORATION

Ecorse, Detroit 29, Michigan • A Unit of

NATIONAL STEEL CORPORATION

District Sales Offices: Boston, Chicago, Cincinnati, Cleveland, Grand Rapids, Houston, Indianapolis, Lansing, Los Angeles, New York City, Philadelphia, Pittsburgh, Rochester, St. Louis, San Francisco, Toledo, Toronto.

By FLOYD G. LAWRENCE *Detroit Editor*



Will facelifts, as with these 1956 Dodges, come between . . .

New New Cars Biennially?

AUTOMAKERS used to share the spinster's belief that a new brand of paint on the same old facade leads to product appeal. In part, that was a belief born of necessity. An automaker can't make basic body changes any easier than a spinster can.

New Pattern—But as competition grows ever keener in the industry, a new and exceedingly costly pattern is emerging: Completely new cars every two years, with a major facelift in between. The completely new cars introduced in 1955, for example, will be completely new once again in 1957. And of almost equal importance will be the facelifts in between. The present pacesetter is Chrysler Corp. Its 1956 models include visibly different rear quarter panels, hoods, grilles, bumpers and even rear deck lids on one line.

This trend is interesting. It means upwards of $1 billion dropping into the tooling coffers every two years, and more salable automobiles with an impact that cannot fail to bolster the residual strength of the economy. It also represents a high watermark on a tide that was only a ripple 30 years ago and could become a flood in the future.

Model T—The classic example of lack of model changes is the model T Ford which evolved from 1908 to 1927 in a manner which can only be described as retiringly. Mechanical changes were made, and even some styling modifications were adopted, but it takes a man who knows the breed to pinpoint the year a particular specimen was made (15 million model Ts were produced).

In large measure, the model T was typical of the era. There were no formal facelifts as we know them today. Changes were made when it was established that they were improvements, often without regard to year. For that reason, models did not coincide with years at all, and the model T lived almost 20 years, the model A about four and the model B one.

Evolution — This pattern coincides roughly with the awakening of the industry to the yearly model change.

As competition began to stiffen among the industry survivors in the late 1920s, a nameless hero hit upon the idea that the public had associated changes with improvements; that changes, whether they were improvements or not, might well sell cars.

Subtle Shift—Thus it was that change for the sake of change, emphasizing newness for the sake of newness, entered the auto industry. People who previously bragged of the reliability of their cars and how many miles they had served without trouble now began to talk of "mine is a '33." Perhaps the change was inevitable, for reliability had moved from the realm of the uncommon to the accepted.

In those days the cost of a "facelift" was numbered in the thousands of dollars. But as the scope of facelifts began to increase, the bill began to mount. The trend has culminated this year in what is perhaps the most costly facelift in the industry's history, the $175-million job of Chrysler Corp. The postwar pattern of three years for a basic body shell and major sheet metal now promises to be reduced to two years.

(Material in this department is protected by copyright, and its use in any form without permission is prohibited.)

Ford's Continental Mark II is more than 18 ft long, but its over-all height is only 4 ft 8 in. Its Dearborn, Mich., plant is designed for low volume, high quality

with changes more significant than ever before in between.

New Era — The impact of this new policy could come close to doubling the cost of each new model introduced year by year. Tool engineers and stylists more than ever are being called upon to work hand in hand to anticipate styling changes and provide for them in the original tooling. Entering the picture: Dies with removable inserts which can be changed to avoid replacing the entire die; jigs and fixtures which can be adjusted or otherwise altered to accommodate new sheet metal; and materials handling devices with clearance for next year's parts.

How much unit tooling cost goes up—or if it goes up at all—is dependent upon how well these men do their work and how well the result sells.

Bigger Gamble—Looking down the road, it's obvious that the gamble on a given model increases as the tooling investment goes up. A bad sales year or two for a firm with marginal capital could spell the beginning of the end. The same could be true of auto suppliers whose changes must be as radical as those of the automakers themselves in many cases—often coming yearly rather than on a two-year basis.

Can completely new lines be introduced every year? One auto company spokesman figures that such a move is at least a long way in the future for two reasons.

First, the time required to design an automobile and tool it is presently about 20 months. That would mean the car ahead would have to be styled without any yardstick of public acceptance, which would increase the chances of a complete market miss.

Second, there is considerable doubt if present tooling capacity could handle the sheer volume of that much retooling every year.

Plastic Tools? — As the automakers go ahead with their move to new cars every second year and major changes in between, a possibility could be plastic tooling which might solve the present bottlenecks.

Though some of the smaller automakers must be looking aghast at the increasing capital demands of the automobile business, the outlook for those who can stand the gaff and for the economy generally is rosy.

Auto, Truck Output

U. S. and Canada

	1955	1954
January	780,780	594,467
February	770,530	574,215
March	955,027	672,858
April	936,994	676,269
May	913,257	621,318
June	825,031	635,540
July	815,324	543,344
August	736,039†	523,799
September		364,441
October		312,078
November		616,395
December		761,954
Total		6,896,678

Week Ended	1955	1954
Sept. 3	105,680	110,995
Sept. 10	98,546	84,743
Sept. 17	146,484	74,026
Sept. 24	151,804	72,804
Oct. 1	143,566†	84,110
Oct. 8	153,000*	81,610

Source: *Ward's Automotive Reports*
†Preliminary *Estimated by STEEL

Exhaust Notes

Ford Motor Co. has just begun its model broadening. In addition to the Continental introduced last week, separate lines of the upcoming Edsel, a super Mercury and a Fairline line of cars are reported in the inner works. Ultimate objective would be eight lines of cars, two per dealer, sharing four body shells and thoroughly covering the market from top to bottom. In effect a normal and deluxe version of each line, the cars are planned as distinctively different in appearance and bearing different names which will peg them in the proper status.

The world's largest stamping plant could be the designation of Chrysler Corp.'s facility to be built near Macedonia, O. To be operated by the firm's automotive body division, the plant will draw steel from Pittsburgh, Youngstown, and Cleveland, feeding 28 lines of presses including 260 machines with up to 1800-ton capacity.

Incidentally, automakers are being shown a new press which can turn out 25 door panels per minute, compared with 15 per minute on machines in use. Secret of the the machine: A lower table which moves up to blank with the top, then comes down to form.

Fuel injection, much talked about in auto circles, appears headed for limbo, according to some. Their reason: Injection is costly, gives only about 10 to 15 per cent increase in fuel economy and 20 to 25 per cent increase in horsepower. Cubic inches, they argue, are cheaper.

WHY ZINC RATES FIRST IN DIE CASTING • NUMBER 5 OF A SERIES

fine appearance as demanded by SCHICK INCORPORATED

The brand-new Schick "25" electric shaver, commemorating Schick's Silver Jubilee, not only is claimed to be a completely new concept in electric shaving, but demonstrates the outstanding results of the latest techniques in precision product engineering. The "business end" of the palm-sized new "25" is composed essentially of the four ZINC die castings illustrated above. When chromium plated, these metal components contrast beautifully with the gleaming white plastic housing.

The ZINC die castings are shown as they are received by Schick from the die caster. Not only are all assembly elements accurately cast, but the design details (note the raised trade mark and the recessed lettering on the nameplate) are sharply defined. *No machining is required* and, since the castings are ZINC, standard plating procedures are used. The right and left hand "whisk-its" (which snap open for easy cleaning) and the shearing head divider are bright chrome. The nameplate is finished in a soft silvery satin with the recessed lettering painted black to provide quick product identification.

Appearance is just one of many considerations which dictate the choice of ZINC die castings in product engineering. Send for our brochure and contact any commercial die caster for the answers to your particular production problems.

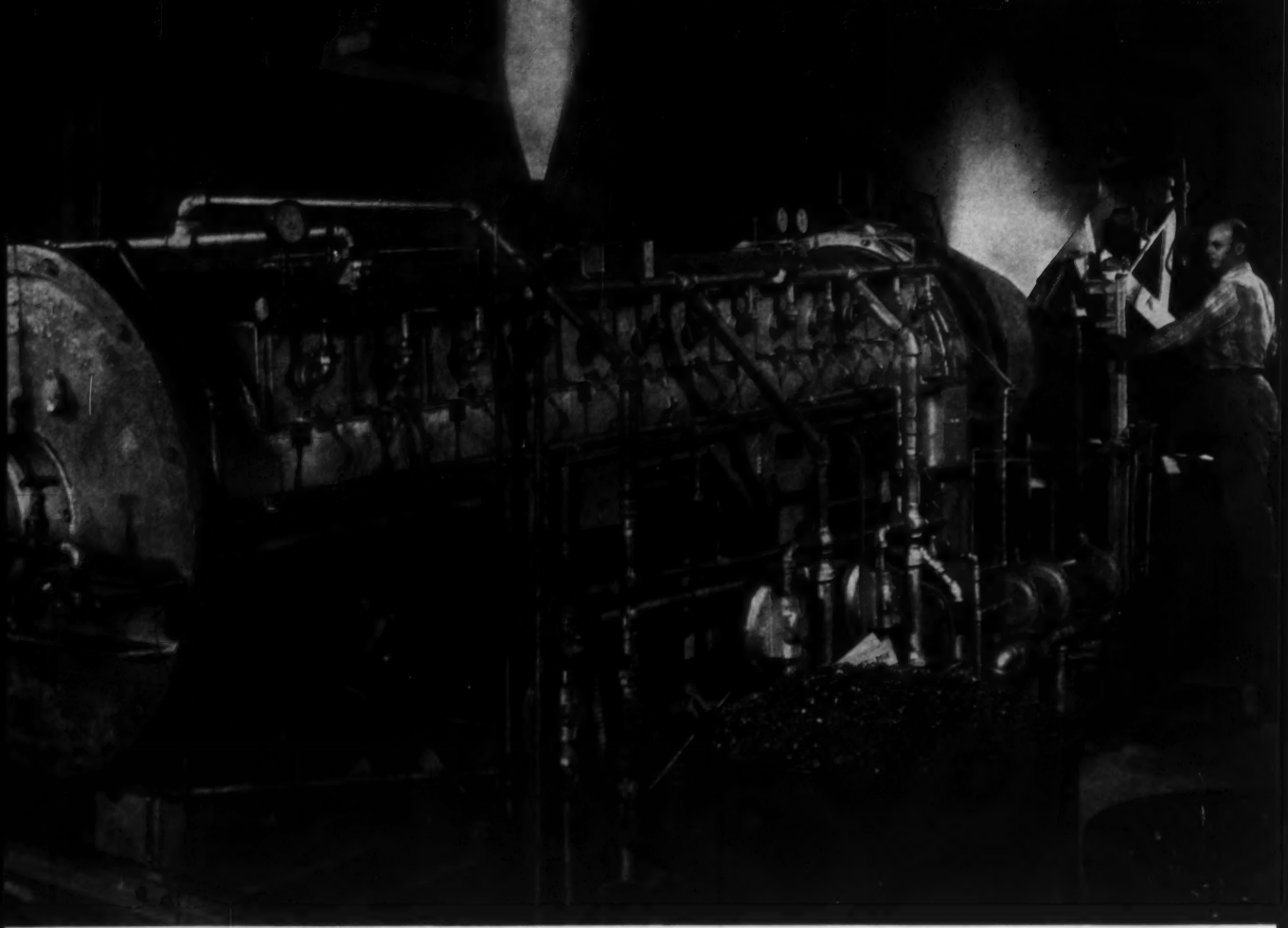
The New Jersey Zinc Company, 160 Front Street, New York 38, N. Y.

ZINC FOR DIE CASTING ALLOYS

The Research was done, the Alloys were developed, and most Die Castings are based on

HORSE HEAD SPECIAL (99.99+% Uniform Quality) ZINC

RB&W FASTENERS - *Strong Point of any assembly*



Gas chamber for fasteners that lengthens their life

CARBURIZING of fasteners is being done here . . . *GAS* carburizing. This method stands head and shoulders above the bath type treatment. It gives greater control of surface hardness, of quality.

Above, Gene Luzzi, has just loaded a hopperful of *Spin-Lock* screws into the chamber. Heated and then quenched under his experienced eye (11 years with RB&W), the screws emerge with deeper, more uniform case hardness, and controlled core strength. RB&W hinge pins, tapping screws and other fasteners get their longer life in this department.

If there's a better method or some extra special equipment that can help turn out the best fasteners possible, you're sure to find it in RB&W plants. With the most modern and complete facilities available, RB&W's skilled operators — many of whom are second generation RB&W men — can put their experience to best advantage.

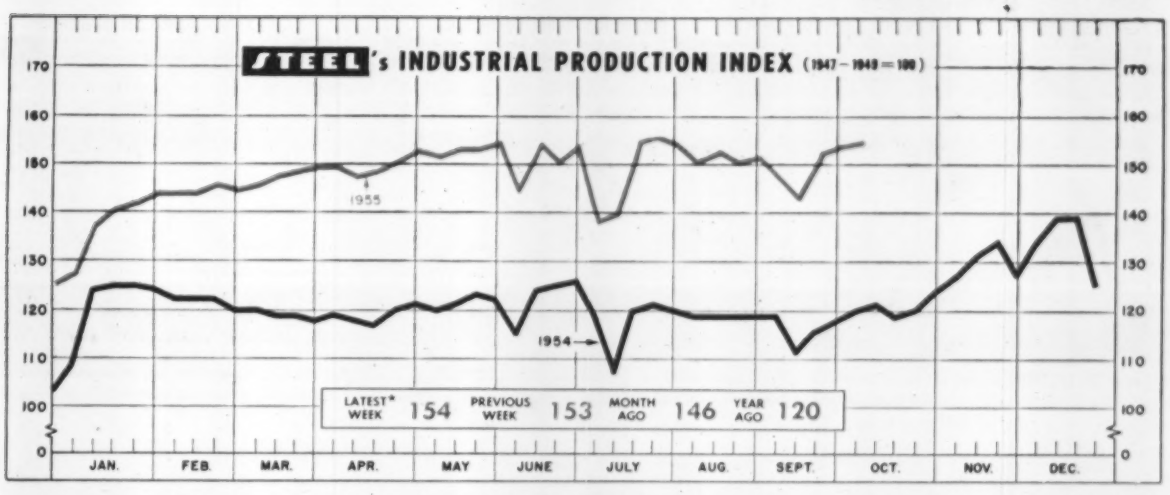
This combination of facilities, experience and quality control can't miss. It assures you more quality for your money . . . a reliable source of supply . . . and strong fasteners that never let you down.

Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, N. Y.

RB&W

110th year

Plants at: Port Chester, N. Y., Coraopolis, Pa.; Rock Falls, Ill., Los Angeles, Calif. **Additional sales offices at:** Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco. **Sales agents at:** Milwaukee; New Orleans; Denver; Seattle. **Distributors** from coast to coast.



*Week ended Oct. 1. Based upon and weighted as follows: Steel Output, 35%; Electric Power Output, 32%; Freight Car Loadings, 22%; and Auto Assemblies, 11%

Business Will Hit New Peaks This Fall

NEW HIRING points the way to booming metalworking activity this fall. Autos will be one of the keys; good times in the auto plants spread out to many corners of metalworking—primary metals, stampings, diecasting (see page 103), hardware. Autos are off to a fast start in the 1956 model year.

Also getting ready for a high level of fall business (as evidenced by swelling employment) are radio and television producers, machinery lines and instruments. Construction suppliers also get into the act, says the Labor department.

More Records — The activity points to a record gross national product in this quarter. Third-quarter GNP poked its nose over the $390-billion mark (annual rate) for a record. The fourth quarter is usually bigger; even in 1953 when the economy was sliding downhill that was true.

Encouraging this year: The momentum GNP has built up is all the result of private demand. Government spending has stayed about level; inventories are building slowly.

Spenders—Going up are spending for producers' durable equipment and plant outlays. Consumer spending is at an all-time high, accounting for about half the rise in GNP over the last year.

Another big factor in boosting GNP is record construction. No slowup is predicted. Dr. George Cline Smith, economist for F. W. Dodge Corp., states that during the next ten years the American economy will pour some $600 billion into building materials, construction labor and services.

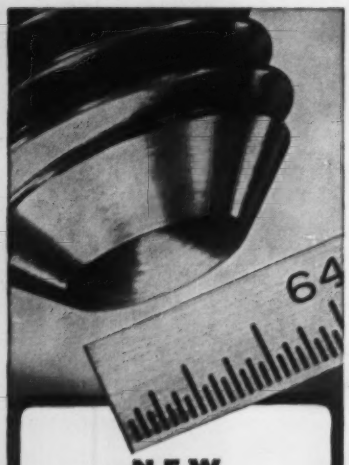
Normal Growth—In that period some 12 to 13 million new housing units will be built. About $450 billion will be spent on new construction, $150 billion on maintenance and repairs.

"This forecast," says Dr. Smith, "is conservative. It does not anticipate any construction boom, but simply a normal growth in line with the expansion of the nation."

BAROMETERS OF BUSINESS

	LATEST PERIOD*	PRIOR WEEK	YEAR AGO
INDUSTRY			
Steel Ingot Production (1000 net tons)[2]	2,330[1]	2,341	1,692
Electric Power Distributed (million kw-hr)	10,800[1]	10,756	9,072
Bitum. Coal Output (1000 tons)	9,635	9,970	8,262
Petroleum Production (daily avg—1000 bbl)	6,680[1]	6,671	6,184
Construction Volume (*ENR*—millions)	$266	$434	$234
Automobile, Truck Output (*Ward's*—units)	143,566[1]	151,804	84,110
TRADE			
Freight Car Loadings (1000 cars)	810[1]	819	710
Business Failures (Dun & Bradstreet, no.)	180[1]	171	212
Currency in Circulation (millions)[3]	$30,323	$30,401	$29,922
Dept. Store Sales (changes from year ago)[3]	+3%	+4%	+3%
FINANCE			
Bank Clearings (Dun & Bradstreet, millions)	$20,480	$22,848	$18,795
Federal Gross Debt (billions)	$277,426	$277,249	$274,669
Bond Volume, NYSE (millions)	$37,455	$22,988	$14,823
Stocks Sales, NYSE (thousands of shares)	21,693	12,038	9,494
Loans and Investments (billions)[4]	$84,516	$84,735	$82,980
U. S. Govt. Obligations Held (billions)[4]	$30,546	$30,940	$35,696
PRICES			
STEEL's Finished Steel Price Index[5]	207.63	207.63	194.19
STEEL's Nonferrous Metal Price Index[6]	264.6	263.2	218.2
All Commodities[7]	111.3	111.4	109.7
Commodities Other than Farm & Foods[7]	118.0	117.9	114.5

*Dates on request. [1]Preliminary. [2]Weekly capacities, net tons: 1955, 2,413,278. 1954, 2,384,549. [3]Federal Reserve Board. [4]Member banks, Federal Reserve System. [5]1935-1939=100. [6]1936-1939=100. [7]Bureau of Labor Statistics Index, 1947-1949=100



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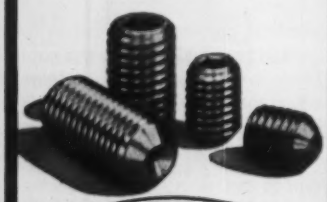

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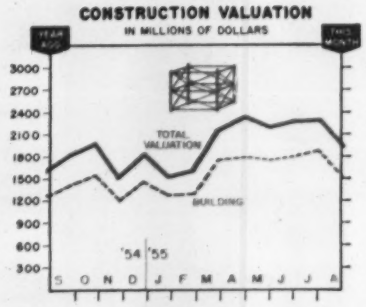
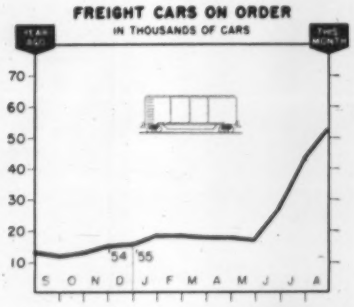
THE BUSINESS TREND





	37 States			
	Total		Building	
	1955	1954	1955	1954
Jan.	1,504.5	1,151.9	1,255.1	935.6
Feb.	1,581.1	1,221.3	1,278.6	977.5
Mar.	2,134.8	1,527.5	1,748.6	1,199.8
Apr.	2,322.1	1,691.9	1,776.1	1,401.6
May	2,185.1	1,925.3	1,737.1	1,497.6
June	2,255.2	1,733.3	1,793.7	1,376.7
July	2,271.5	1,836.9	1,851.6	1,386.9
Aug.	1,894.8	1,572.9	1,516.9	1,243.3
Sept.	.....	1,816.2	.....	1,424.2
Oct.	.....	1,965.3	.....	1,522.8
Nov.	.....	1,498.9	.....	1,199.8
Dec.	.....	1,828.8	.....	1,463.0
Total	.....	19,770.2	.....	15,628.8

F. W. Dodge Corp.

	Awards		Backlogs (end of month)	
	1955	1954	1955	1954
Jan.	5,087	2,942	18,395	27,959
Feb.	2,690	2,057	18,633	25,441
Mar.	2,156	348	17,974	20,966
Apr.	2,706	909	17,930	17,817
May	3,041	1,071	16,886	15,615
June	13,365	1,139	27,102	13,860
July	18,007	883	42,888	12,889
Aug.	13,405	2,425	52,803	13,013
Sept.	....	2,396	.....	11,993
Oct.	....	2,704	.....	12,853
Nov.	....	3,754	.....	14,805
Dec.	....	2,685	.....	15,317
Total	....	23,313		

American Railway Car Institute

Charts copyrighted, 1955, STEEL

A Basic Annual Market . . .

Keeping homebuilding at a high rate will be nonfarm household formations (estimated at more than 800,000 in the past year) and 300,000 to 400,000 housing units estimated to be withdrawn from the market each year. While many other factors influence housing demand, the pressure of household formations, combined with the disappearance of existing housing, should provide a basic annual market for 1.2 million to 1.3 million housing units a year during the decade.

Dr. Smith adds: "Obviously, this forecast does not envision a major war or depression during the decade, because there seems to be little basis for expecting either. On the other hand, it does not assume a runaway boom but actually would allow leeway for a mild recession during one or two of the ten years."

Comeback in Machine Tools . . .

Machine tool orders in August made a small gain over July to round out the first eight months of 1955 at 41 per cent higher than at this time last year. The month was third best of the year, according to the National Machine Tool Builders Association.

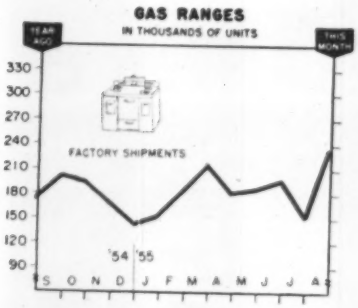
Orders outpaced shipments $65.4 million to $48.8 million. Result was that backlog grew to almost 6 months—a figure most builders look on as close to ideal. The present 5.7-month backlog is the nearest it has been to the six-month "goal" in about two years.

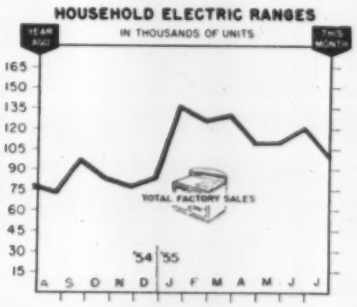
For the fourth straight month, total bookings of fabricated structural steel exceeded 300,000 tons. The August total showed an increase of 16 per cent over the corresponding month of last year. Total bookings to date are 37 per cent ahead of the same 1954 period, reports American Institute of Steel Construction.

Shipments in August of 266,715 tons were 22 per cent over July, though down from a year ago. To date, shipments of 1.9 million tons are 12 per cent under last year at this time. Backlogs pushed up to 1.8 million tons, highest since the end of 1953.

Atoms for Peace . . .

Nuclear research reactors selling for about $200,000 are now a practical goal, says Malcolm P. Ferguson, president, Bendix Aviation Corp. Cost has run $2 million.





	Shipments—Units		
	1955	1954	1953
Jan.	152,900	137,000	169,200
Feb.	186,200	152,900	185,900
Mar.	217,300	188,200	208,200
Apr.	182,300	172,400	220,300
May	187,400	163,800	181,000
June	196,500*	174,300	166,600
July	149,500*	134,500	159,000
Aug.	233,400*	179,400	186,800
Sept.	.....	203,900	209,500
Oct.	.....	197,100	203,900
Nov.	.....	174,000	158,500
Dec.	.....	147,300	134,400
Total	.....	2,024,800	2,183,300

Gas Appliance Mfrs. Assn.

	Total Factory Sales—Units		
	1955	1954	1953
Jan.	136,663	101,870	88,145
Feb.	127,188	109,647	114,465
Mar.	130,180	115,393	130,788
Apr.	108,619	92,751	118,999
May	109,263	82,649	114,404
June	120,100	85,854	113,086
July	83,652	80,017	77,836
Aug.	.....	75,907	74,326
Sept.	.....	99,611	84,481
Oct.	.....	84,321	73,422
Nov.	.....	79,340	55,748
Dec.	.....	85,033	73,870
Total	.....	1,092,393	1,119,570

National Electrical Mfrs. Assn.

"The significance of this cost reduction is that the reactor has now become an economically practical tool for industrial and university research," Mr. Ferguson points out. "With the increasing availability of research reactors to scientific groups, the engineering problems involved in the use of atomic energy—such as the effect of radiation on different materials and the utilization or disposal of radioactive by-products—may be solved and the age of atomic power can become a reality.

"The manufacture of radioactive isotopes — those useful variations of the elements which have been found so effective in medicine, agriculture and industry—also will be accelerated as a result of the commercially practical reactor."

Good Business Ahead . . .

American business will continue at a high level through the remainder of 1955 and into 1956, believes Gilbert W. Chapman, president, Yale & Towne Mfg. Co.

Mr. Chapman's confidence is based on his observations of business in general and Yale & Towne's outlook in particular. With 16 per cent more sales for the first eight months of 1955 than in the same 1954 period, the company's net earnings are way up. Rate: more than 200 per cent higher than last year's. Orders already booked for the remainder of the year indicate a fourth quarter of even higher earnings. It's possible that Yale & Towne could finish up 1955 with net earnings double those of last year.

Trends Fore and Aft . . .

Resistance Welders Manufacturers' Association reports business in the first eight months is 30 per cent above orders during that part of 1954. Shipments for the period are up 12 per cent . . . Makers of diesel trucks have a good chance to set a production record in 1955 . . . George A. Bryant, president, Austin Co., sees the next 12 months as "increasingly difficult" for builders using steel, copper, cement and other critical materials and equipment . . . Freight car loadings in the fourth quarter will be 9.3 per cent above those of last year, say the 13 Regional Shippers Advisory Boards of the Association of American Railroads . . . McDonnell Aircraft Corp. expects to further increase employment, which is already approaching the 1953 peak.

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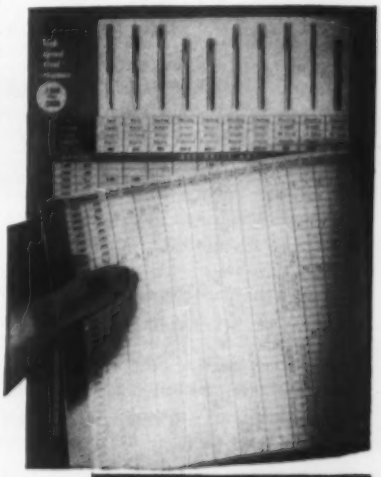

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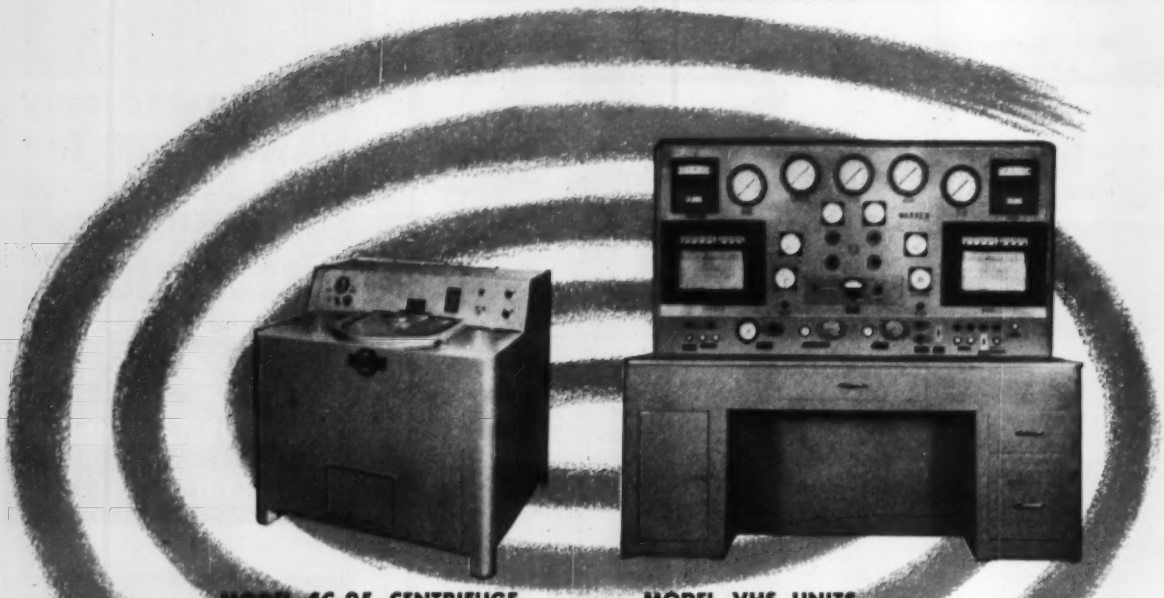

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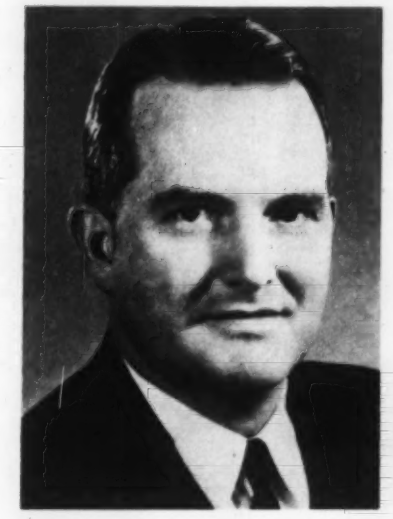


JEROME F. FERDINAND
. . . Punch Products sales manager

C. IRWIN HOCHHAUS
. . . Penco Metal Products plant mgr.

RUSSEL B. CAPLES
. . . Anaconda v. p.-metallurgical operations

Jerome F. Ferdinand was made sales manager, **Punch Products Corp.**, Niagara Falls, N. Y. He recently resigned from Wales-Strippit Corp., where he was vice president-sales and a director.

John P. Borda was made general manager, **Magnus Metal Division**, National Lead Co., New York. **Edward M. Van Winkle** becomes president of Magnus Metal Corp., subsidiary. Both positions were held by **William V. Burley**, also a vice president of National Lead, who has retired.

J. T. Lancaster, manager of engineering, was appointed plant manager of **Rycenga Mfg. Co.**, Detroit. He will direct all production and engineering facilities.

Orrin W. Barker, since 1952 chief engineer, **Kearney & Trecker Corp.**, Milwaukee, was elected vice president-engineering. He succeeds **Joseph B. Armitage**, who continues as vice president-consultant.

D. J. Livengood was promoted to plant manager at **West Engineering Co. Inc.**, Richmond, Va. He is replaced by **Robert L. Alexander** as plant superintendent.

Neil E. Geisler was promoted to chief production engineer of **Geuder, Paeschke & Frey Co.**, Milwaukee.

C. Irwin Hochhaus was made plant manager of Alan Wood Steel Co.'s new **Penco Metal Products Division**, Conshohocken, Pa. He was with De Luxe Metal Furniture Co.

American Welding & Mfg. Co., Warren, O., named **Willard R. Richards** production control supervisor; **R. E. Goodman**, quality supervisor; **Forrest W. Johnson**, plant metallurgist; and **Raymond F. Zeller**, chief inspector.

Ralph C. Moffitt, director of purchases, was elected assistant vice president and director of purchases for **United States Steel Corp.**, Pittsburgh. He assumes duties of **R. L. Van Cleve**, assistant vice president-purchases, who has retired. **William W. Crawford** was made assistant director of purchases and **Everett G. Barrett**, purchasing agent, electrical and mechanical equipment. Mr. Barrett retains his present position of purchasing for foreign operations.

Thomas W. Eastwood was made general sales manager of **Permattach Diamond Tool Co. Inc.**, Milford, N. H. He was with Austin-Hastings Co.

C. L. Peterson was elected vice president and general manager, **Brown Instruments Division**, Philadelphia, Minneapolis - Honeywell Regulator Co.

Russel B. Caples, president of Anaconda Aluminum Co., was elected vice president-metallurgical operations of the parent company, **Anaconda Co.**, New York. He will be assisted by **William Wraith Jr. C. Jay Parkinson** was elected vice president of Anaconda Aluminum and **Robert F. Buechner** was named assistant to the president.

Andrew Kalitinsky was appointed manager of the nuclear research and development department at the Fort Worth, Tex., plant of **Convair**, a division of General Dynamics Corp. He succeeds **Dr. R. N. Little** who has returned to the University of Texas faculty.

W. R. Miller was named director of manufacturing at **Longren Aircraft Co.**, Torrance, Calif.

Robert B. Murray Jr., former undersecretary of commerce, was made a vice president and a director of **Baldwin - Lima - Hamilton Corp.**, Philadelphia. He has been assistant to the B-L-H president since leaving his government post. **James M. White** was elected vice president - manufacturing, resigning a similar post at ACF Industries Inc. **Col. John R. Martin**, U. S. Air Force, ret., was elected vice president-electronics and instrumentations.

Robert A. Daggit was made assistant sales manager for the Chi-

ROBERT A. YOUNG JR.
. . . Continental Electric sales mgr.

C. DON HICKS
. . . Michiana Products vice president

RALPH R. SWAIN
. . . Bailey Meter division mgr.

cago plant of **Joseph T. Ryerson & Son Inc.**

Robert A. Young Jr. was made sales manager of **Continental Electric Equipment Co.**, Cincinnati. He was sales representative for General Cable Corp. **R. E. Welch** was made controller.

Richard G. Widdows, chairman of **Electric Controller & Mfg. Co.**, Cleveland, has retired. He continues as a director and in a consulting capacity. Mr. Widdows joined the company in 1909 and served as president from 1943 to 1952.

Lithium Corp. of America Inc., named **Herbert H. Schroeder Jr.** coordinator in the new product research and development department at Minneapolis.

H. F. Devens was made sales manager for Roll Bond in the metals division of **Olin Mathieson Chemical Corp.**, New York.

Theodore F. Smith joined **Kaiser Engineers Division,** Henry J. Kaiser Co., Oakland, Calif., as industry consultant. He is assigned to industrial development and will have offices at regional headquarters in Pittsburgh.

George F. Unbehaun was made sales manager and **Donald Aingworth** general manager of **Herbster Furnace Co.**, Cleveland, subsidiary, Bettcher Mfg. Corp.

C. Don Hicks was elected vice president of **Michiana Products Corp.**, Michigan City, Ind. He was formerly with Eaton Mfg. Co.

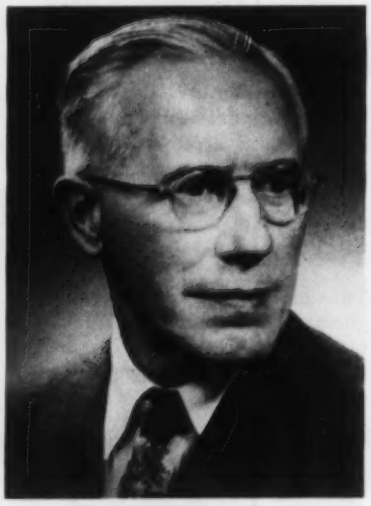
William A. Damerel, as assistant to the works manager, heads a new division at **Whitney Chain Co.**, Hartford, Conn., which will produce automotive original-equipment timing chains.

Henry M. Heyn and **Albert L. Hollinger** were elected vice presidents of **Surface Combustion Corp.**, Toledo, O. Mr. Heyn was sales manager, heat treat division. Mr. Hollinger was manager, steel mill division.

Ralph R. Swain was named manager, iron and steel division, **Bailey Meter Co.**, Cleveland. He has been a member of the firm's sales department since 1941.

Charles R. Fraser was appointed assistant to the director of purchases at **Oldsmobile Division,** Lansing, Mich., General Motors Corp. He is succeeded by **Seward H. Van Ness** as divisional buyer of productive raw material.

In the metals processing division of **Curtiss-Wright Corp.** at Buffalo, **G. I. Sundstrom** was made assistant general manager; **Melvin Isaacson,** general sales manager;



HENRY M. HEYN

ALBERT L. HOLLINGER

. . . Surface Combustion Corp. vice presidents

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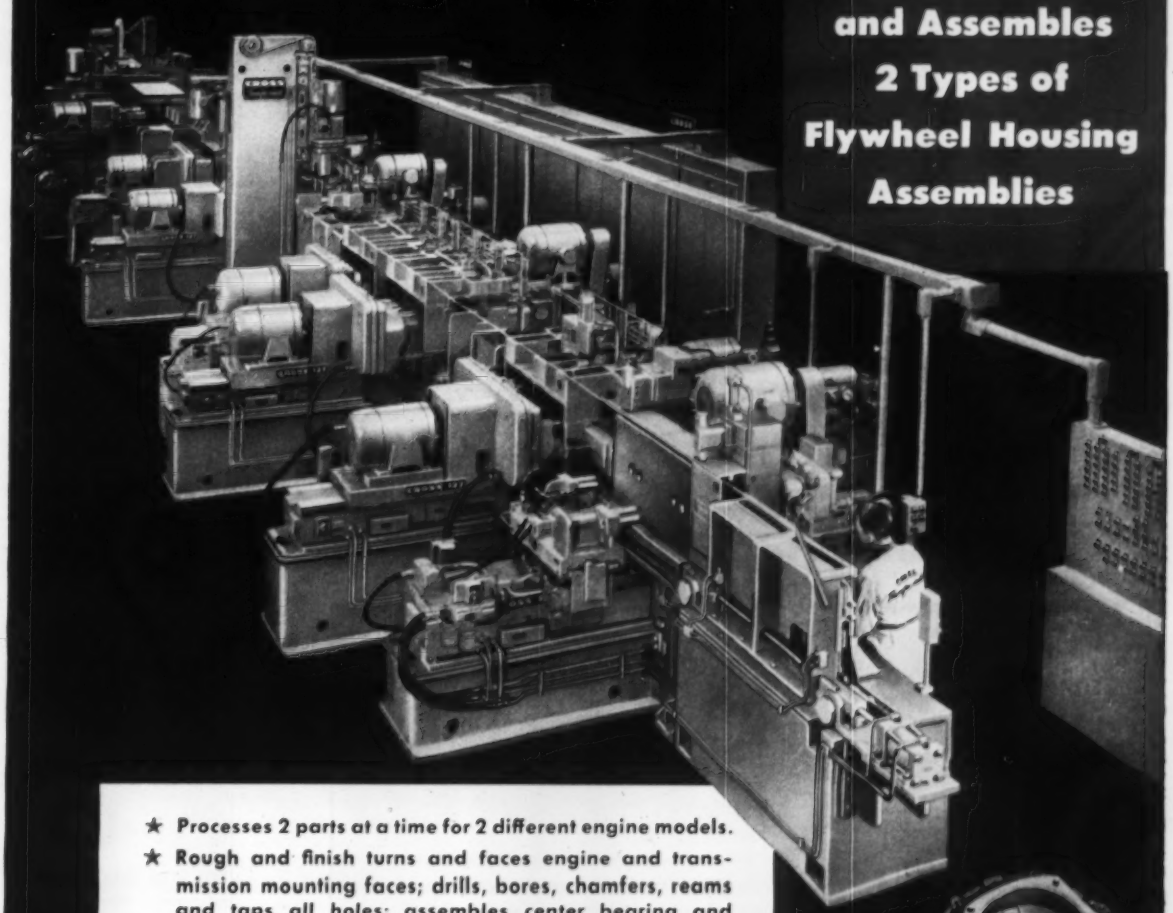
Bores, Faces, Drills and Assembles 2 Types of Flywheel Housing Assemblies



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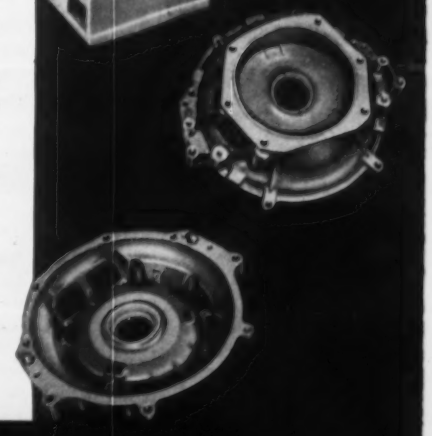

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ROBERT E. SCHROEDER
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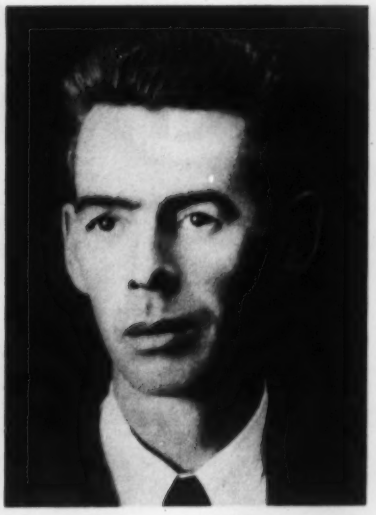


JOHN H. BOUWMEESTER
. . . General Ceramics v. p.-mfg.

and **John G. Rombough**, industrial relations manager.

Robert D. Fleischer was named sales manager, safety tool division, **Beryllium Corp.**, Reading, Pa. **Walter S. Pollard** was made advertising and sales promotion manager.

P. T. Lagrone was made manager of electric utility sales for **Westinghouse Electric Corp.**, Pittsburgh. He succeeds **C. V. Roseberry**, who was named manager of the new commercial atomic power department. **Dr. William E. Shoupp** will be technical director of that new department. **George B. Meyer** was made manager of defense products, Dayton, O., office; and **Romus Soucek**, manager of defense products, West Coast, with headquarters in Los Angeles.

R. E. Dietz Co., Syracuse, N. Y., appointed **G. L. Petrie** purchasing agent to replace **Charles F. Marchant**, who will retire Jan. 1.

Robert E. Schroeder was made Cleveland district manager of **Luria Bros. & Co. Inc. Merle Nobel** will supervise activities in the Cincinnati area.

J. S. Gillespie, manager of product planning, was made manager of the new diamond project section of General Electric Co.'s **Carboloy Department**, Detroit.

Harold H. Hill was made general manager, automotive finishes, **Pittsburgh Plate Glass Co.**, Pittsburgh.

E. G. Hotze succeeds **F. H. Hayes** as Houston district manager of **Clark Bros. Co.**, Olean, N. Y. Mr. Hayes, vice president and district manager at Houston, has retired.

Benjamin S. Head was made superintendent of the finishing department at the Defiance, O., plant of **Central Foundry Division**, General Motors Corp.

General Ceramics Corp., Keasbey, N. J., appointed **John H. Bouwmeester** vice president of manufacturing and a director. He held a similar position with Indiana Steel Products Co. **James W. Schallerer** was made project engineer.

A. Henry Casey was made manager, closed circuit television division, **Hallamore Electronics Co.**, a division of Siegler Corp. He has headquarters in Chicago. Mr. Casey was assistant general sales manager of Ekco Products Co.

Edwin B. James was made assistant sales manager of **McKay Machine Co.**, Youngstown.

Barnabus P. Toth was named sales engineer of **Hamilton Mfg. Co.**, New Haven, Conn.

Frank L. Rubin, heat transfer engineer, joins the sales engineering staff of **Downingtown Iron Works Inc.**, Downingtown, Pa.

OBITUARIES . . .

Harry F. Kellogg, 76, president, **Central Screw Co.**, Chicago, died Sept. 21.

Theodore S. See, 70, vice president, **La Salle Steel Co.**, Hammond, Ind., died Sept. 22.

Edwin W. Hanke, 47, plant superintendent for **Allen-Bradley Co.**, Milwaukee, died Sept. 20.

Dr. Joseph B. Ennis, 76, former senior vice president, **American Locomotive Co.**, died Sept. 22 in Paterson, N. J.

George T. Kearns, 54, secretary-treasurer and a director of **Kennametal Inc.**, Latrobe, Pa., died Sept. 25.

Adolph W. Machlet, 90, chairman of **American Gas Furnace Co.**, Elizabeth, N. J., died on Sept. 27.

Hyman Wernick, 62, president, **Sterling Metal Products Co.**, Newark, N. J., died Sept. 27.

C. R. Genung, metallurgist, **Ross-Meehan Foundries**, Chattanooga, Tenn., died Sept. 25.

John R. Van Dusen, 54, regional manager at Cleveland for **Wayne Pump Co.**, died Sept. 29.

Mill circles and angles in one set-up with

tri-D MILLING HEAD
KEARNEY & TRECKER MILWAUKEE

Pat. No. 2286821
Other Pat. Pend.

Here, operator uses TRI-D Milling Head to perform a variety of intricate milling operations on a workpiece—straight, circular, angular, radii—all in a single set-up. Angular adjustment of cutter in vertical plane is an exclusive feature of TRI-D.

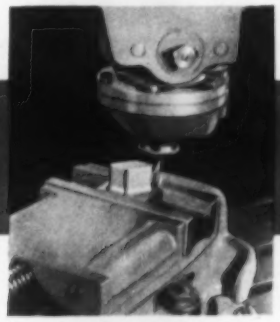
For tool rooms, die shops or production milling — — do it faster, easier with new TRI-D attachment

Kearney & Trecker's new TRI-D Milling Head — featuring rotary, lateral and angular adjustment in vertical plane — is ideally suited for rough and finish milling of various geometric shapes — straight lines, radii, circles, angles — all in a single set-up. It can be easily mounted on almost all horizontal and some vertical milling machines . . . *regardless of make.*

Illustrated here are some of the intricate operations the TRI-D performs.

Learn what the TRI-D can do for you — how different it is from all other types of milling heads in use today. For "proof-positive" demonstration, see your Kearney & Trecker representative. Contact him today, or write Kearney & Trecker Corporation, 6784 W. National Ave., Milwaukee 14, Wis.

Die (left) and punch (right) are rough and finish milled in a single set-up, using all three basic movements of the TRI-D and milling machine. Prescribed feeds and adjustment of TRI-D is all that's required to finish both workpieces.

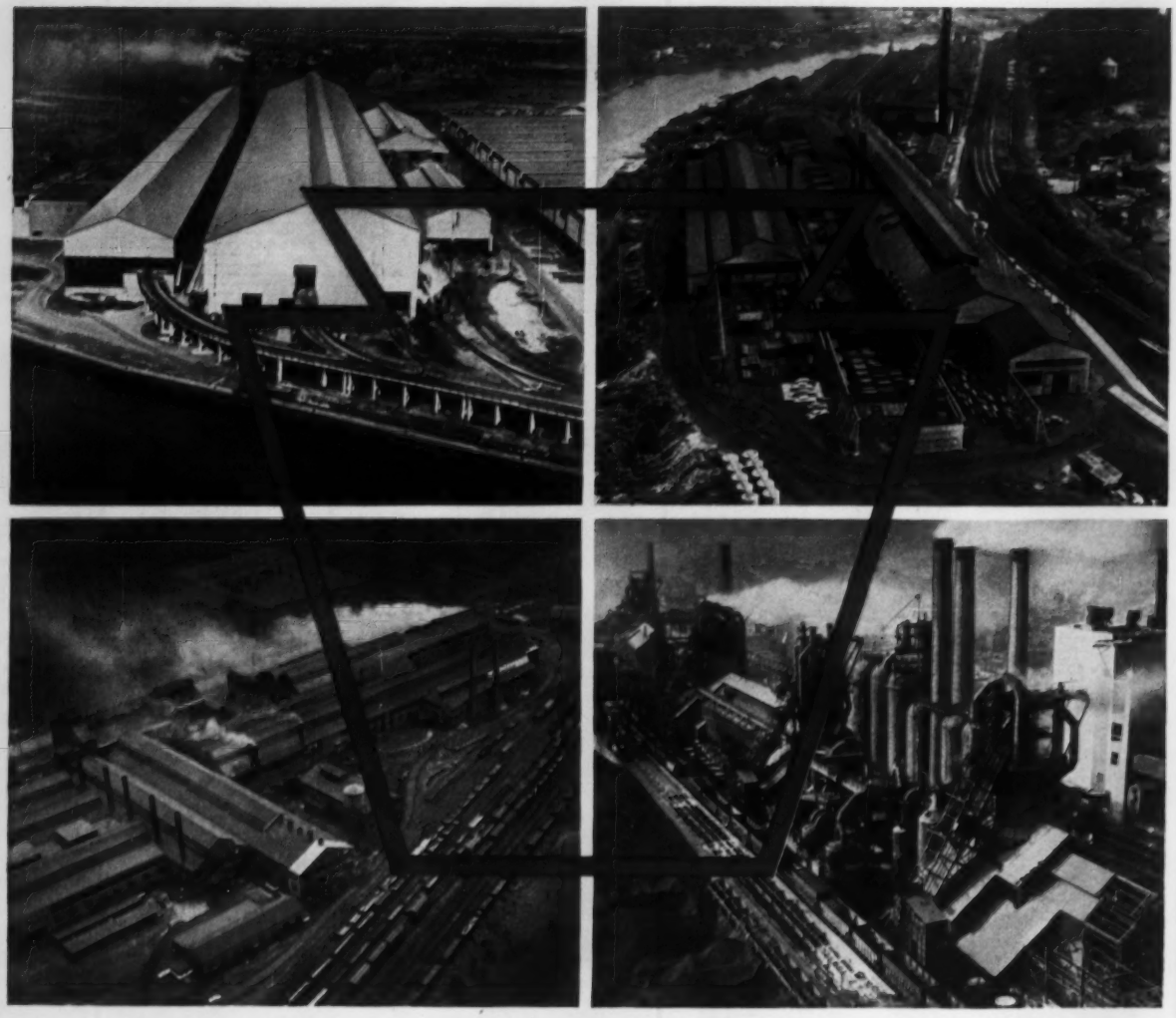


Angular setting of TRI-D, with an ordinary end-mill ground to a specific angle, is used to mill the "square corners."

Kearney & Trecker CORPORATION MILWAUKEE 14, WISCONSIN
KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS

Builders of Precision and Production Machine Tools Since 1898

For more information on Kearney & Trecker's new TRI-D Milling Head, write for catalog No. TD-10.



Plenty of Reasons for Plenty of Steel Mills on the Pennsylvania Railroad

★ Largest, most up-to-the-minute facilities at Atlantic and Great Lakes ports for rapid, economic handling of iron ore.

★ Equipment, know-how and clearances for handling oversize shipments from port to producing plants.

★ Fast, direct access to essential raw materials—coke, limestone, scrap, etc.

Here's Why

STEEL GROWS WHERE THE PRR GOES!

★ Largest fleet of freight cars for fast movement of crude, semi-finished and finished products to consuming markets.

★ An abundance of labor.

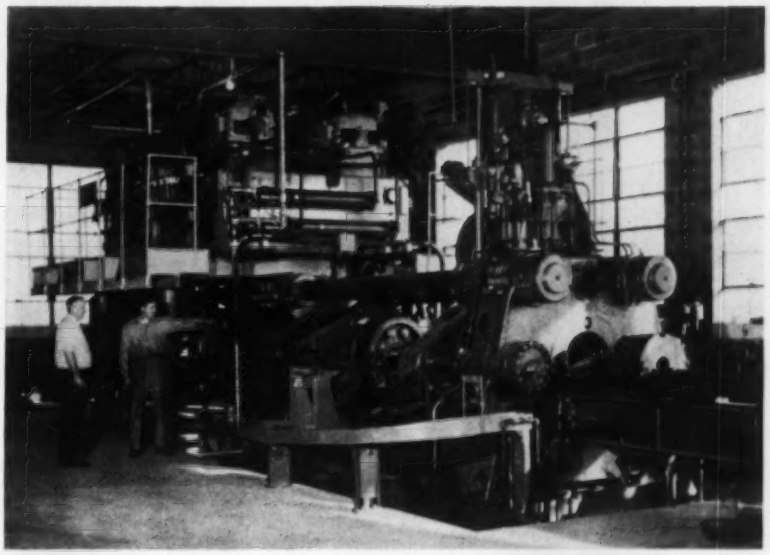
★ The PRR serves more communities and a greater population than any other transportation system which gives you access to the world's greatest markets.

Desirable plant and warehousing sites are available. Consult any of the Pennsylvania Railroad Industrial Agents listed here.

CHICAGO	INDIANAPOLIS	PITTSBURGH	CLEVELAND	PHILADELPHIA	NEW YORK
C. D. WILKINS	V. J. FLOYD	H. C. MILLMAN	R. REAM	A. J. VONK	F. J. HASSON
Union Station	Union Station	Penna. Station	Pennsylvania Station	Pennsylvania Station—30th St.	Pennsylvania Station
CEntral 6-7200	*MElrose 5-9331*	*GRant 1-6000*	*ENdicott 1-2121*	*EVergreen 2-1000*	*PEnnsylvania 6-6000*
Ext. 268	*Ext. 373*	*Ext. 688*		*Ext. 3981*	*Ext. 2471*

D. B. LENNY, General Industrial Agent, Suburban Station Bldg., Philadelphia 4, Pa.
EVergreen 2-1000 *Ext. 8011*

PENNSYLVANIA RAILROAD



Reading firm offers rod, tubing, special shapes as . . .

Beryllium Industry Matures

BERYLLIUM - COPPER wrought products of improved quality are available to industry in larger quantities and in wider varieties. Reason: A two-year, $2-million expansion program at Beryllium Corp., Reading, Pa., which is just about completed.

For the first time, the industry is using mass production and quality control techniques that have been applied successfully in steel and aluminum mills.

Wider Market — "Growing acceptance of beryllium copper as a design material . . . as well as the prospects of new commercial applications now in pilot-run stages, more than justify this major modernization program," explains Lawrence F. Boland, vice president.

Expansion of wrought alloy finishing capacity by 60 per cent is but one phase of an over-all program that calls for eventual enlarging of company facilities for production of beryllium master alloys as well as commercial casting ingot. As part of its current modernization program, Beryllium already has stepped up its capacity for production of beryllium-aluminum master alloy.

Diversification—Included in the present expansion are a $450,000 extrusion press (above) that will produce seamless beryllium-copper tubing and special shapes of a type never before available in production quantities; a $160,000 Sendzimir cold-rolling mill of advanced design that permits production of thinner-gage, closer-tolerance beryllium-copper strip, in commercial widths almost twice that previously available; and a $100,000 direct reading spectrometer that automatically analyzes foundry samples for as many as 12 metallic elements while a heat is still molten.

Additional new equipment includes: Cold-finishing mills, high-volume annealing furnaces; auxiliary continuous strip welding, bar-rolling, straightening and slab milling production machines.

Beryllium expects to get a large measure of product diversification from its giant new hot extrusion press. It will be used initially to supplement the plant's hot mills in the production of standard rod and wire stock, but the new press probably will be producing quantities of seamless beryllium-copper tubing soon. By the end of the year, the company hopes to be extruding special structural shapes.

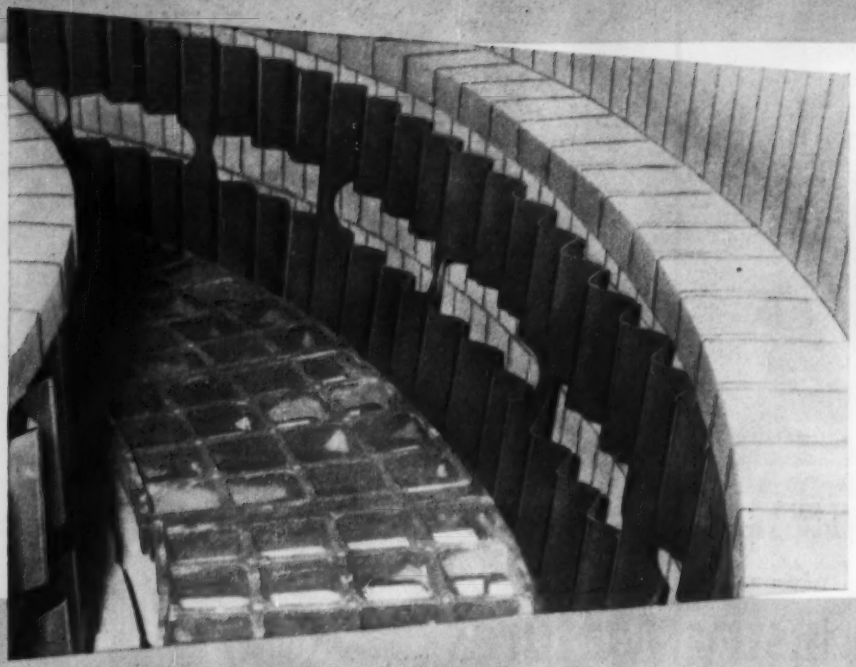
(*Please turn to page* 130)

making a
MARKED IMPROVEMENT
in COLOR
CODING products

Industry's color-coding needs range from simultaneous application of up to six bands on wire lead electrical components to color banding drill chucks in the tool business. Meeting these needs are Markem machines (like the 69A shown), type and ink—which do the job faster, better and at lower cost than tedious hand methods ever could. When size, shape or material of your product, part or package poses a marking problem, get the benefits of Markem's 44 years of experience. Write or call Markem Machine Co., Keene 30, New Hampshire.

MARKEM ...TO MAKE YOUR MARK

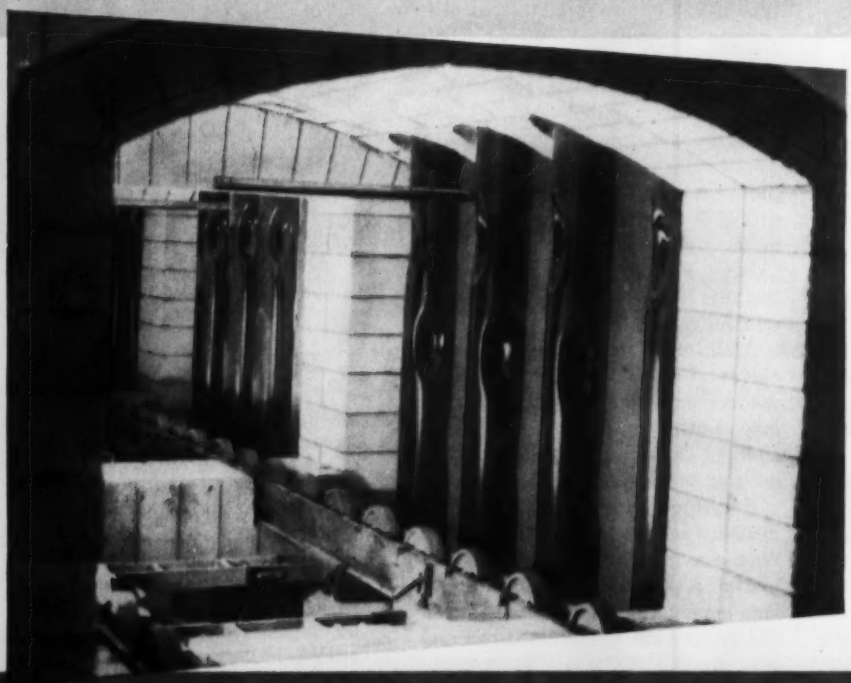
NOW AVAILABLE IN FIELD-ERECTED FURNACES



ELECTRIC

CORRTHERM elements are large corrugated sheets of nickel chromium and were developed in Lindberg laboratories by Lindberg metallurgists and engineers. At the left, installation of CORRTHERM elements in large rotary furnace currently being erected by Lindberg Industrial in plant of a leading automotive parts manufacturer.

FOR ELECTRIC FURNACES ... FOR GAS FURNACES



GAS

The famous Lindberg "dimple" vertical radiant tube, designed by Lindberg engineers has proved its superior efficiency in hundreds of furnace installations since 1953. The photograph at the left shows its installation in a large pusher-type furnace built for a leading automotive manufacturer.

Visit Lindberg Industrial Corporation Booth 500 at the ASM Show in Philadelphia, October 27 to 31. See these revolutionary new heating elements and get full details of LIC service.

LINDBERG

LINDBERG INDUSTRIAL

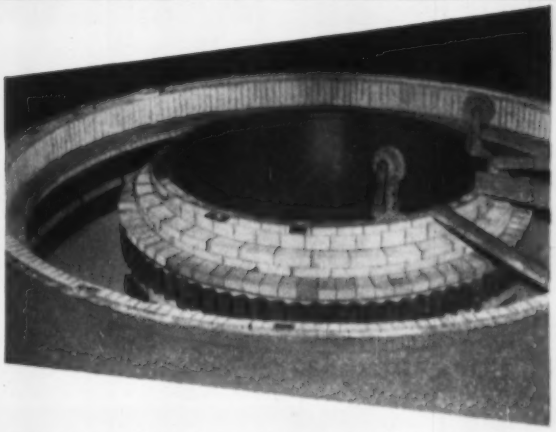
BY LINDBERG INDUSTRIAL !

Where source of heat is electricity!

CORRTHERM, Lindberg's radically advanced new electric heating element offers advantages never before available for heat treating furnaces. With this new element even carburizing and carbonitriding with electricity becomes practical, efficient and economical.

CORRTHERM elements operate at extremely low voltage. Consequently, leakage through carbon saturation and shock or short hazards are eliminated. Elements also act as baffles to direct circulation of convection streams.

CORRTHERM elements are practically indestructible. Work load or operator's charging tool can't hurt them. Watts density is at all time low. Easily installed or replaced, too, as element merely hangs in furnace and no complicated mountings are required.



A construction photo of one of two large rotary carbonitriding furnaces now being built by Lindberg Industrial for a leading automotive parts manufacturer. A section of this same furnace is shown on the opposite page.

THE MOST ADVANCED HEAT ELEMENTS YET DEVELOPED

Where gas is the source of heat.

Because of Lindberg's revolutionary design, this tube provides a new level of furnace performance. The secret lies in the new Lindberg tube's "dimples." The tube carries a central stream of mixed air-and-gas surrounded by a cylindrical stream of air alone. Combustion occurs in the area between these two streams. The "dimples" create eddies accelerating combustion and maintaining even temperatures along the entire tube.

This Lindberg tube will operate at maximum efficiency for a longer period of time. The special protective coating gives greatest possible resistance to carbon penetration. Vertical position eliminates soot deposit and resultant temperature increases at points of sooting.

Tubes are just 59 inches long and weigh only 29 pounds, changeable in a few minutes. No costly furnace shut-downs and no high labor and material cost for tube changes.

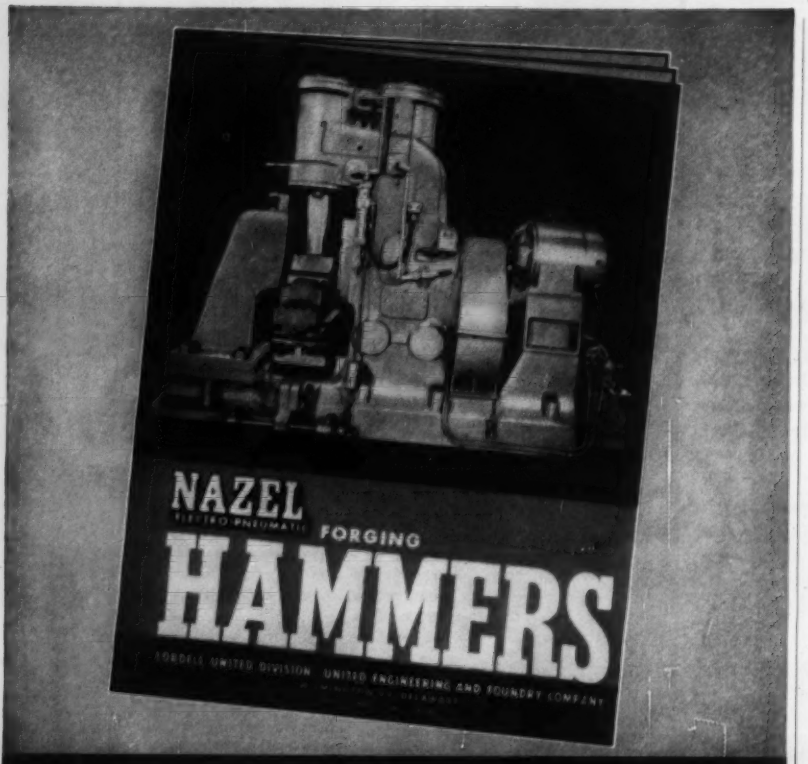
This three-row pusher-type carburizing furnace provides maximum heat uniformity through use of Lindberg vertical radiant tubes installed between each row as well as at side walls, providing accurate control of case depth and properties. This highly efficient furnace with Lindberg vertical radiant tubes carburizes 650 lbs. of gears per hour with an effective case of .055".

INDUSTRIAL CORPORATION

Specialists in Field-erected Equipment

CHICAGO PLANT: 2321 WEST HUBBARD STREET, CHICAGO, ILLINOIS
LOS ANGELES PLANT: 11937 REGENTVIEW AVE., AT DOWNEY, CAL.

Lindberg Industrial provides a complete consulting, designing and construction service including completed installation in your own plant. Call your nearest Lindberg Field Representative (see classified section of your telephone book) or write us direct.



NOW! THIS NEW BULLETIN

TELLS ALL ABOUT NAZEL ELECTRO-PNEUMATIC FORGING HAMMERS

The new, 20 page NAZEL Hammer Catalog gives the reasons why NAZEL is the world's most widely used Electro-Pneumatic Hammer. One of the reasons is because NAZEL Electro-Pneumatic Forging Hammers are *completely self-contained* . . . do *not* require compressors, boiler, piping, nor fuel. Just the "touch of a button" and the NAZEL is ready to operate . . . and a press of the foot-treadle for the lightest to heaviest ram blow.

For every requirement, the various types and models of NAZEL Hammers are on display in this new Hammer Catalog . . . along with specifications and examples of specific installations and applications.

Write, today, for your copy of this new NAZEL Hammer Catalog.

LOBDELL DIVISION
UNITED ENGINEERING AND FOUNDRY COMPANY

1836 WILMINGTON 99, DELAWARE 1955

(*Concluded from page* 127)

Cold-Rolled Products — Immediate expansion in product lines is made possible by new cold-rolling equipment. Included are: Wider strip, up to 11 in.; thinner gage strip, down to 0.001 in.; larger coil sizes, weighing up to 600 lb; commercial straight wrought stock in sizes larger and smaller than previously available (rod stock down to 0.0625 in. in diameter; rectangular and hexagonal stock up to 2 in. thick); smaller rectangular bar stocks, down to 0.094 in. on a side.

The extrusion press can exert a force of 1700 tons on hot beryllium-copper billets weighing up to 100 lb. It will more than double Beryllium's hot working capacity, permitting the firm's hot mill to work almost exclusively on strip production. Initial extrusions will range from 5/8 to 1 9/16-in. in diameter, though smaller sizes may be produced with multiple extrusion dies.

Initial production of seamless beryllium-copper tubing will be in redraw sizes of about 2 in. in diameter.

Engineering Firm Expands

Arthur G. McKee & Co., petroleum and steel engineering firm, will erect a $500,000 building to expand its home office and engineering facilities in Cleveland. The building will add about 35 per cent to its present 84,000 sq ft of floor space.

Starts Can Plant Construction

American Can Co., New York, has broken ground at Arlington, Tex., for a can factory to help meet the requirements of the expanding food packing industry in central Texas. Production is scheduled to start during 1956 and will reach an annual rate of 300 million containers a year at full capacity.

Chicago Distributor Expands

Diamond Steel Co. Inc., Chicago, distributor of steel and aluminum products, acquired the L. A. Cohn foundry building at 5429 W. Roosevelt Road, that city. The new property will house Diamond

BUILDS EXTRA SELLING POWER INTO YOUR PRODUCTS

THEY *buy A.W. STRIP Steel, too!*

(Hot and cold rolled)

'They' are the people who buy products made with ALAN WOOD strip steel. 'They' are housewives, children, manufacturers—you and I.

Perhaps they can't always *see* the superior qualities derived through precise, metallurgical control and "custom-production" of strip steel—but they *do* know these qualities must be present—because of the product's strength, dependability and reputation.

If you require strip steel, your products deserve the "custom-produced" qualities of superior strip . . . for minimum waste . . . less wear and tear on tools . . . easier, faster production. They deserve ALAN WOOD strip steel.

For products requiring hot or cold rolled strip or sheets, call upon the services of a versatile, integrated steel specialist with modern, up-to-date, continuous mills—where steel is produced to your specific requirements—ALAN WOOD STEEL COMPANY.

IRON PRODUCTS
"Swede" *pig iron*
STEEL PRODUCTS
Plates (sheared)
Hot rolled sheets
Hot rolled strip
Cold rolled sheets
Cold rolled strip
ROLLED STEEL FLOOR PLATE
A.W. ALGRIP *abrasive*
A.W. SUPER-DIAMOND *pattern*
A.W. CUT NAILS
MINE PRODUCTS
COKE
COAL CHEMICALS

ALAN WOOD STEEL COMPANY

steelmasters for 129 years • CONSHOHOCKEN, PENNA.

DISTRICT OFFICES AND REPRESENTATIVES: Philadelphia • New York • Houston
Los Angeles • Atlanta • Boston • Buffalo • Cincinnati • Cleveland • Detroit • Pittsburgh
Richmond • St. Paul • San Francisco • Seattle • Montreal and Toronto—
A. C. Leslie & Co., Limited

SM-39

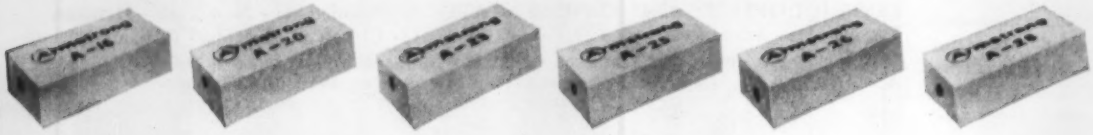
Neat Brickwork...

edges and corners of Armstrong Insulating Fire Brick resist handling damage

Neat brickwork, free of chipped edges and broken corners, reflects credit upon your workmanship. It's an important sales advantage for the furnace builder where appearance of the lining effects acceptance of the job. Because Armstrong Insulating Fire Brick have exceptional strength, they will not break under normal handling conditions, will provide heat-tight joints and a neat appearance.

Send for free booklet giving full details on the entire line of Armstrong Insulating Refractories. Write Armstrong Cork Company, 2710 Reed Avenue, Lancaster, Penna. Call in your Armstrong engineer for expert help the next time you have a furnace building or lining problem.

Armstrong INSULATING REFRACTORIES



Steel's Flat Rolled Products Division. The firm's present plant on North Natoma avenue will be maintained for its Aluminum Division. After remodeling, the building cost will be more than $300,000. The company is spending $25,000 for new mill-type equipment. Expansion also will take place in plate, bar, structural and wire departments.

REPRESENTATIVES

Lewis-Shepard Products Inc., Watertown, Mass., appointed E. D. Bement Jr. representative in the St. Louis area.

Westinghouse Electric Corp., Pittsburgh, appointed Claud S. Gordon Co., Chicago, distributor of its standard industrial furnaces and related equipment. L. H. Gillette is sales manager, Industrial Heating Division, Meadville, Pa.

Hunter Spring Co., Lansdale, Pa., appointed Mezey Agency Inc., Detroit, representative for Michigan and adjoining sections of Indiana and Ohio. Hunter makes springs and wire forms of all kinds, stampings and wire and spring testing instruments.

Heyl & Patterson Inc., contracting engineers, Pittsburgh, appointed George M. Meriwether, Birmingham, as sales representative for its special materials handling equipment.

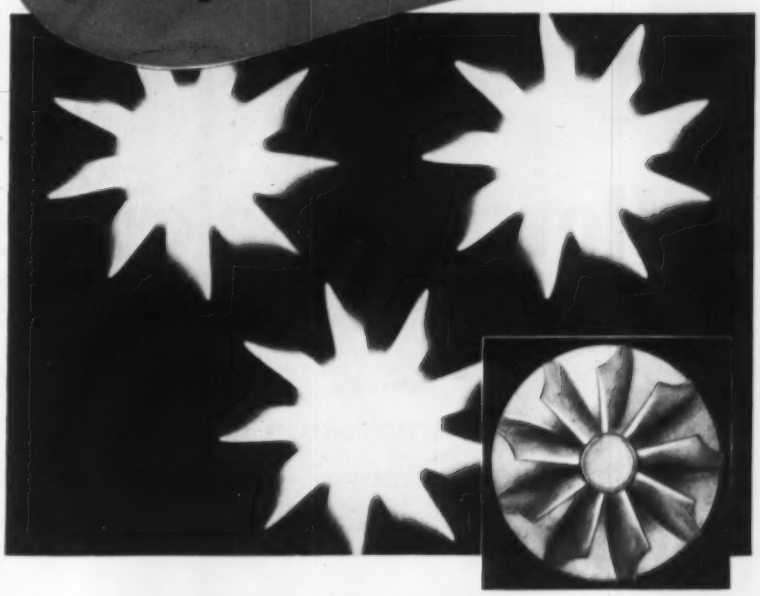
Vascoloy-Ramet Corp., Waukegan, Ill., appointed the following distributors for its cemented-carbide tools, toolholders, inserts and dies: Empire Tool Engineering Co., Tucson, Ariz.; Cameron Tool & Supply Co., Cameron, W. Va.; Precision Tool & Engineering Corp., Philadelphia.

Lewis & Co., Louisville, has been appointed representative in that district for **Jones & Laughlin Steel Corp.'s Container Division,** Pittsburgh.

Pratt & Whitney Division, Niles-Bement-Pond Co., West Hartford, Conn., appointed Southwest Industrial Sales Co., Dallas, as its representative.

INSIDE STORY

Austenal Quality Control



The same technique used in the investment casting of finely-wrought surgical and dental applicances in non-machinable metals is put to work for modern industry in Austenal's unique Microcast process. Complex precision parts, such as turbine buckets and vanes or the wheels pictured above by X-Ray, are cast directly, eliminating costly machining and holding finishing to a minimum.

From the initial mold to the finished casting, Austenal's skilled technicians check for correctness of detail and dimensional accuracy. Then, the completed part is subjected to Zyglo and X-Ray examination to search out any internal structural flaws and assure that each part released by Austenal will deliver according to the highest performance standards.

Through sound production, skilled engineering and rigid Quality Control, Austenal serves a growing need in American industry and national defense for finer, high-performance precision castings.

See Austenal's original informative 16mm color movie, "A Story of Industrial Progress". Available without charge.

austenal®

LABORATORIES, INC.

microcast division

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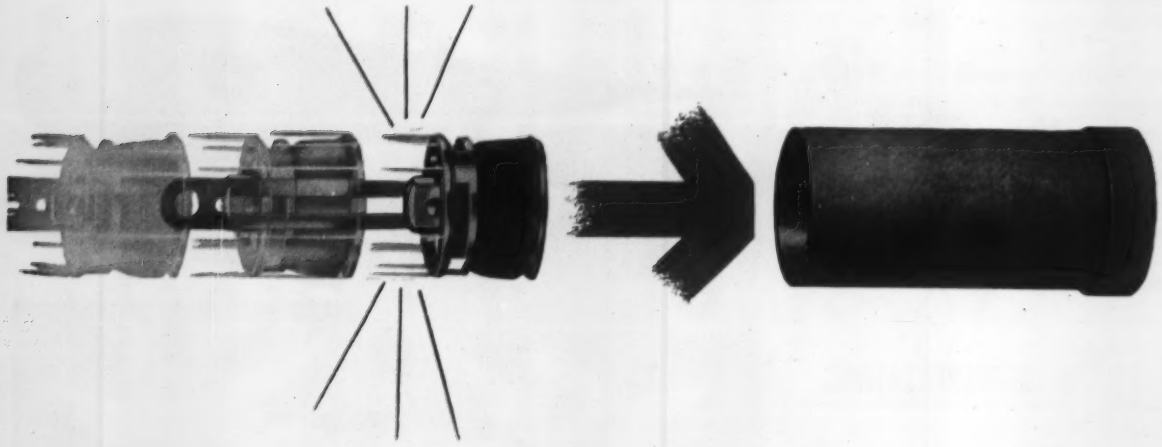
7001 SO. CHICAGO AVE. · CHICAGO 37, ILL.



How to soak up shock and

Underwood Corporation did it by using Republic ELECTRUNITE Stainless Steel Tubing

This was the problem: find a material for the cylinder in the carriage shock absorber on an accounting machine. The cylinder must have an accurate bore, little variation in diameter, and negligible eccentricity. It must also have a suitable finish to reduce drag, because the piston which fits inside must be completely retracted in less than a tenth of a second.

Republic metallurgists suggested ELECTRUNITE Stainless Steel Tubing. It was drawn to meet dimensional requirements. The finish was excellent. And Underwood reports good service life because of excellent wearing qualities.

Republic Steel Corporation
3120 East 45th Street
Cleveland 27, Ohio

REPUBLIC STEEL

- ☐ Enduro® Stainless Steels
- ☐ ELECTRUNITE® Stainless Steel Tubing and Pipe
- ☐ Republic Nuts and Bolts
- ☐ Republic Chateaugay Pig Iron

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

K-7000

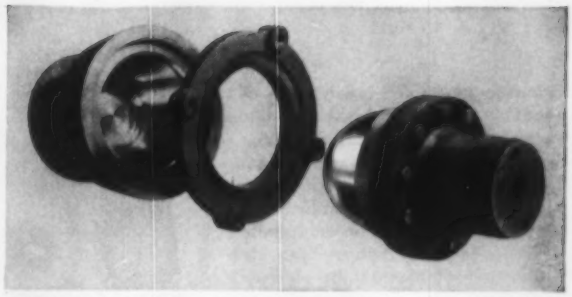
BUSINESS MACHINE PARTS COST LESS because they last longer when they're made of Republic Enduro Stainless Steel. On this Addressograph-Multigraph office machine, ink corroded the carbon spring steel from which the ribbon guards and lister spacing bands were made originally. Carbon steel also cracked under the operating strain. Enduro Stainless Steel resists this corrosion, has the necessary springiness and wears well, despite the abrasive action of moving the ribbon.

cut costs!

Underwood now saves 75 cents on material costs for each shock absorber.

This is only one of many customers for whom Republic has saved money. Sometimes we save material costs. Sometimes production costs. Often, both. And since we manufacture both stainless steel and carbon steel tubing in many analyses, we are equipped to help solve all kinds of tubing problems.

Fill out the coupon below for more facts on Republic ELECTRUNITE Mechanical Tubing. Or call your nearest Republic district sales office.

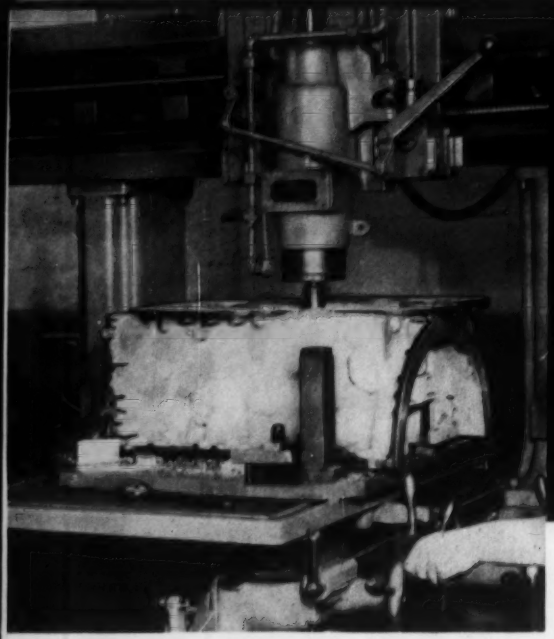


ECONOMICAL MACHINING IS ONLY ONE REASON why a leading maker of heat-resistant glass products uses Republic Chateaugay Pig Iron for glass molds. This premium pig iron, supplied exclusively by Republic, also assures a dense, fine grain structure; longer mold life; fast-flowing and even-cooling characteristics. Hard surfaces resist heat and wear.

CUTTING COSTS ALSO APPLIES TO BUYING FASTENERS for your assembly and maintenance work. One call to your Republic Distributor gets all the fasteners you need. There's no shopping around, no time lost. Paper work is reduced. And, you get exactly what you want because Republic makes and stocks over 20,000 types and sizes of regular fasteners, everything from machine bolts to sheet metal screws. You can depend on Republic Fasteners for quality, uniformity, ease of application, long service life. Quick delivery, too.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products



If limits are measured in .0001ths

chances are

Fafnir has a bearing on it

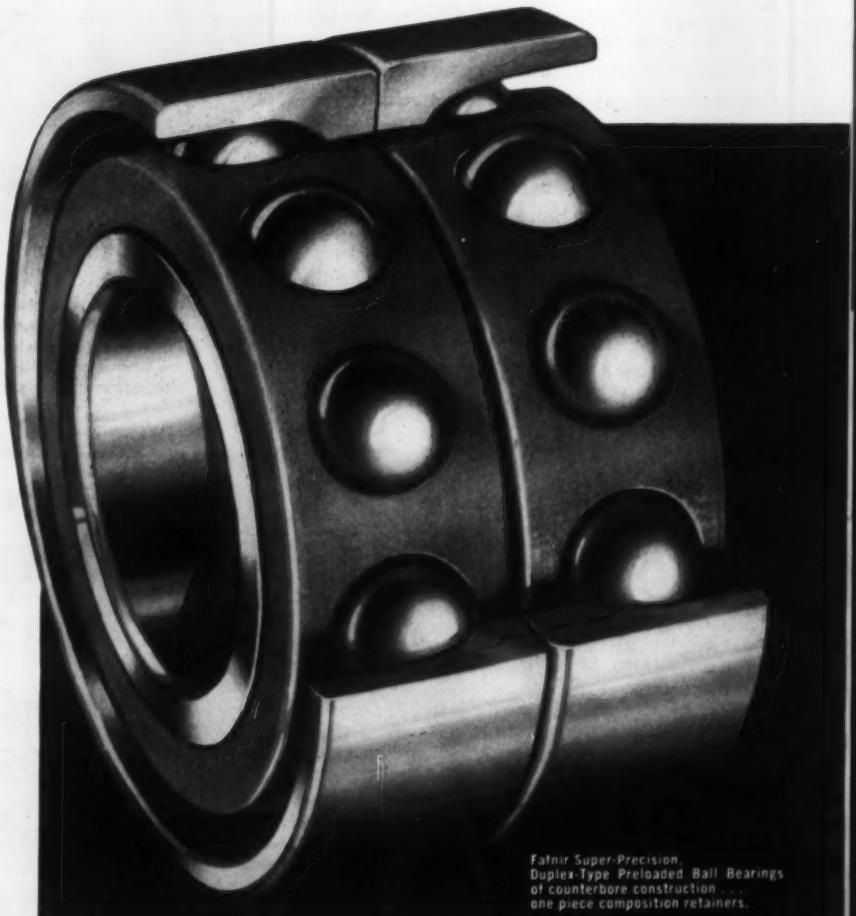
Precision designing and construction of the spindle head illustrated make possible extremely accurate profiling or milling at twelve operating speeds ranging from 260 to 6200 rpm. Design specifications include four pairs of Fafnir Super Precision Ball Bearings on the spindle shaft. These "jewels of industry" provide the ultimate in axial and radial rigidity. They run cool under exacting conditions of load and speed . . . conserve power . . . need no adjustment . . . and are permanently grease-packed.

It's in places like this where limits are in .0001ths that you find Fafnir Super-Precision Bearings . . . because they are *manufactured* in a separate super-precision department to the highest standards of dimensional control . . . in a wide range of sizes and types. There could be no better example of the "attitude and aptitude" of Fafnir engineers toward solving bearing problems.

If bearings are important to you, a few minutes spent with a Fafnir representative may help you get the right answer quickly.

The Fafnir Bearing Company,
New Britain, Connecticut.

MOST COMPLETE LINE IN AMERICA



Fafnir Super-Precision, Duplex-Type Preloaded Ball Bearings of counterbore construction . . . one piece composition retainers.

FAFNIR BALL BEARINGS

STEEL
The Metalworking Weekly

The Metal Show Section

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ARCWELDING ELECTRODE BUYER'S GUIDE 142

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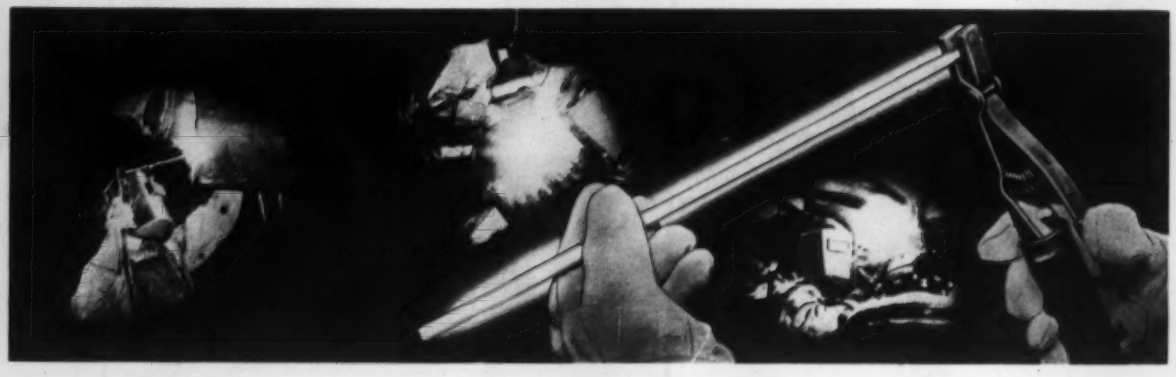


Choose the Right Arc Welding Electrode

By L. K. STRINGHAM
Vice president, engineering
Lincoln Electric Co.
Cleveland

THE DIVERSITY of metals which can be deposited in arc welding is staggering. This fact leads many people to believe the same to be true about electrode selection. However, when this diversity is better understood you can eliminate the guesswork in your selection and get consistently good welded joints.

Electrodes have been developed to meet the requirements of three groups of factors, all of which control (to some degree) what is best for any given application. The electrodes:

1. Supply deposited metal for making joints in different metals and alloys.
2. Provide required properties in the deposited metal.
3. Meet widely varying operating conditions under which the weld must be made and provide for service requirements of the weld other than those supplied by properties.

The Variables — A weld may have to meet any one of four, or combinations of these four, service requirements:

1. Liquid or air tightness under varying pressure conditions.
2. Good appearance.
3. X-ray quality inspection.
4. Joint strength equal to full plate strength.

These varying requirements become even further involved when you consider the wide range of welding conditions under which they must be met. They are:

1. Position of welding.
2. Fit-up of joints.
3. Type of joint.
4. Cleanliness of metal.
5. Gage size or thickness of metal.
6. Operator skill.
7. Type of welding current, ac or dc.

How to Control Them — The chemical analysis of coatings on electrodes is controlled to produce desired operating characteristics. Through coating control the arc must be made more or less forceful to give degrees of penetration. Size of droplets of metal in the arc, bead shape and smoothness, type of shielding, amount of slag and coating efficiency under heat can all be controlled by the electrode coating. Some characteristics however, are achieved at the expense of others.

Table 2 gives the important differences in operating electrode characteristics which distinguish the subdivisions within carbon steel classifications. An understanding of these differences is important if welds are to meet service requirements. Table 3 gives the applications as recommended by AWS-ASTM specifications. Beyond these characteristics and recommendations which are only general as to position and joint is a great volume of explanation for specific applications. The following will hit only the highlights.

Penetration at Normal Current

This is the penetration or arc force found at the current normally used with a specific electrode. Many factors may set this normal current. Undercut, spatter, cracking, porosity and the change in arc characteristics from the start to the finish are a few.

Within broad limits any amount of penetration can be achieved with any type or size of electrode if the proper current is chosen and penetration is the only thing you are after. For example, 3/8-in. penetration is possible with a 3/32-in. EXX12 rod. But this isn't practical since the current would be so high that penetration might drop from 3/8-in. at the start of the rod to 1/16-in. at the finish.

Gaseous and Molten Shields

Some types of electrodes have large quantities of combustible (organic) material in the coating. This material burns in the arc and produces a gaseous shield to protect the molten metal. When an electrode has little of this combustible material in the coating, weld metal is protected mainly with a molten slag shield.

As a general rule, electrodes which produce large quantities of molten slag produce small amounts of gaseous shields, and vice versa.

Rate of Slag Solidification

The slags which solidify at a

high temperature normally have a high rate of solidification. Such slags are used on electrodes with which a whipping welding technique is used. Molten slag solidifies very quickly after the arc is removed from the crater.

Although the quick solidifying slags tend to confine the bead and keep it from running, they do not normally produce a smooth weld bead.

Arc Blow Stability

If there are no unbalanced forces acting, an arc will normally take the shortest path between the electrode and the work and will tend to travel between the two molten points. Therefore, as the electrode is moved along the seam the arc tends to lag behind, appearing to have a slight backward blow.

In addition to these tendencies there are two types of forces acting upon the arc which produce arc blow. One is the unbalanced magnetic field set up by the current flowing in the arc and in the work, the other is the arc force produced mainly by the chemicals in the electrode coating and the sheath at the tip of the electrode.

The former is at right angles to the arc and tends to blow the arc away from the tip of the electrode. The latter tends to make the arc "shoot" straight off the end of the electrode in bullet fashion. This arc force can be directed by pointing the electrode in the direction you want the arc to go. The resultant of the two arc forces and the tendency of the arc to lag behind create the arc blow.

The operator has little control over either, but he does have control over the arc force produced by the electrode coating. If this force is high and the magnetic force is low, direction of the arc can successfully be controlled. If the converse is true the operator has little or no control over arc blow.

Electrodes designed especially with the "soft arc" or for ac operation have very little arc force produced by the coating. Thus the operator has very little control over arc blow. But since the magnetic forces are much less on ac than on dc, the resultant arc blow on ac generally causes no difficulty.

The longer the mechanical arc length the more pronounced the resultant blow is. The coating produces such a long sheath over the ends of "hot" electrodes that the mechanical arc length is long and the resultant arc blow may be great even though arc force is relatively high.

Uniformity of Bead

Most mild steel electrode coatings contain chemicals which break down when the coating becomes hot. This is often accompanied by a change in the arc force or penetration, spatter, undercut, size of droplets, slag removal, shape and porosity of bead.

The degree to which the various changes occur will depend on the coating design and will therefore vary with the different electrodes.

Freedom from Cracking

There is no definite relationship between the ability of weld metal to elongate in an all-weld-metal tensile specimen and its tendency to crack in welding a joint. A

Electrode	Welding Positions	Polarity	RECOMMENDED USE
EXX10	All	Positive	Where good penetration and small amount of slag is important; excellent for multiple pass applications in vertical and overhead positions; radiographic requirements can be met; galvanized steel.
EXX11	All	AC or positive	Same as EXX10.
EXX12	All	Negative or AC	Largest tonnages used in flat and horizontal positions for single-pass, high-speed, high-current fillet welds; good appearance, easy operating, withstands high currents and bridges gaps where fit-up is poor.
EXX13	All	Negative or AC	General production welding as recommended for EXX12; easier operating at low currents and low open-circuit voltages; smoother bead than EXX12; some are made especially for sheet metal; flat fillet shape, easier slag removal.
EXX15	All	Positive	For higher-strength, high-carbon alloy steels; eliminates underbead cracking in welding these steels; high-sulfur free-machining steel and high tensile steels require this; for steels generally considered hard to weld.
EXX16	All	AC or positive	Same as EXX15.
EXX20	Horizontal fillets and flat	AC or negative	For high-speed welding of heavy plate; meets radiographic requirements; high currents usually give high deposition rates on heavy plates; not used on thin plate; known as a "hot rod".
EXX24	Horizontal fillets and flat	AC or DC	Principally for fillet welds on mild steel; welds are slightly convex in profile, with a very smooth surface and extremely fine ripple approaching the appearance of an automatic weld; smooth, quiet arc; very low spatter; low penetration and is operable at high lineal speeds; a drag type electrode.
EXX27	Horizontal fillets and flat	AC or DC	Well suited for the welding of heavy sections; flat to slightly concave profile; easily passes most rigid radiographic requirements; smooth, fine ripple and good metal wash-up on sides of fillet; current ranges for various diameters are higher than for all other classifications.
EXX30	Flat only	AC or positive	Deep-groove welding in heavy plate in the flat position only.

concave bead shape does exhibit the greatest cracking tendency, so long arcs or weaving techniques which might produce concave beads should be avoided when cracking is encountered.

Freedom from Surface Holes

The statement, "the greater the tendency for surface holes, the less tendency for internal holes," while true, must be made with reservations. Improvements in some electrodes (the EXX15-16, for instance) have practically eliminated external holes yet the welds remain free of internal porosity.

Freedom from Sticking

As a general rule, the higher the current used on a particular electrode the less tendency it has to stick. For a given current there is generally less sticking with dc than with ac current. When an electrode is designed specifically for dc it may tend to stick on ac operation. If the current is raised high enough to prevent sticking, the coating may break down making it impossible to use the full electrode length. Some electrodes designed specifically for ac are slow when used on dc operation . . . slower than those designed for dc.

To have satisfactory stability for a given type of electrode, an industrial machine must be capable of producing an arc which will not pop-out under normal welding conditions. On limited-input machines some special electrodes might be considered satisfactory even though the arc popped-out once or twice in each electrode.

Rating of machine stability is based on the minimum open circuit voltage on which the electrode will satisfactorily operate. The following table lists the open circuit voltages corresponding to the ratings on the chart.

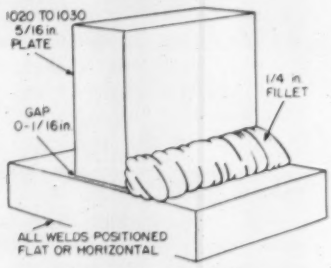
Machine Stability Required	Minimum machine open circuit voltage for stable operation (approximate)
High	d-c machine (or a-c machine with 80 v or higher)
Medium high	70 v
Medium	60 v
Medium low	55 v
Low	45 v or less

• *Extra copies of this article and the electrode buyers guide on page 142 are available in quantities from one to three until supply is exhausted. Write Editorial Department, STEEL, Penton Bldg., Cleveland 13, O.*

How to Choose the Right Electrode

It's a matter of matching electrode characteristics with job requirements

Example 1.—Flat and Horizontal Position Fillets



Job Requirements

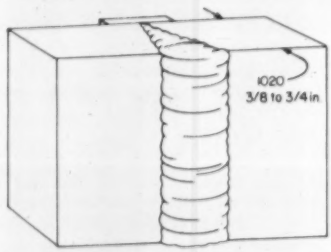
1. Most economical weld . . . competitive situation
2. Good weld appearance
3. Clean welds—easy slag removal—no spatter on weldment
4. Analysis good to fair — welds free of cracks—some 1035 being used
5. Ac welding equipment

Using the Chart

1. Take Job Requirement No. 1. Find characteristic that affects it most —in this case Deposition Rate. All electrodes with good deposition rates get a checkmark.
2. Repeat this procedure with the other four job requirements. On completion, chart will resemble the one at right.
3. Then read down the vertical columns on the chart. The electrode that has all check marks is the best choice for the job.

								EXX24		
• 5 — 1	x	✓	✓	✓	x	✓	✓	✓	✓	✓
2	x	x	x	x	x	x	✓	✓	✓	✓
• 1 — 3										
4										
5										
6										
7										
8										
9										
10										
11	✓	x	x	✓	x	x	✓	✓	✓	
12										
13										
• 4 — 14	x	x	✓	x	✓	✓	x	✓	x	x
15										
• 3 — 16	x	x	x	✓	x	x	✓	✓	✓	x
17										
18										
19										
20										
21										
22										
• 2 — 23	x	x	x	x	x	x	✓	✓	✓	✓

Example 2.—Vertical and Horizontal Butt Welds



Job Requirements

1. X-ray quality required
2. Ac welding equipment
3. All-position welding
   a. Flat head easiest to handle and most economical
   b. Minimum slag interference

Using the Chart

Follow same procedure as in Example 1. Note in this case (see schematic) that Requirement No. 3 is affected by three categories on the characteristics chart . . . Gaseous Shield Bead Shape and Weld Appearance.

Those electrode characteristics which apply to the two example problems have been underlined on the chart (p. 141). For further identification, the lines marked with black dots apply to Example 1 and those with stars refer to Example 2.

		EXX11								
☆ 2 — 1	x	✓	✓	✓	✓	x	✓	✓	✓	✓
2										
3										
4										
5	✓	✓	x	x	x	x	x	x	x	x
6										
7	✓	✓	x	✓	✓	x	✓	x	x	
☆ 1 — 8	✓	✓	x	✓	✓	✓	✓	✓	✓	✓
9										
10	✓	✓	x	x	x	x	x	x	x	x
11										
☆ 3										
13										
14										
15										
16										
17										
18										
19										
20										
21	✓	✓	x	x	x	x	x	x	x	x
22										
23										

Electrode Characteristics

	Coating Type	High Organic		High Rutile		High Mineral					
								High Iron Oxide			
	Electrode AWS Class	High Cellulose Sodium EXX10	High Cellulose Potassium EXX11	High Titania Sodium EXX12	High Titania Potassium EXX13	Sodium EXX15	Potassium EXX16	EXX20	EXX24	EXX27	EXX30
● ★	1. Polarity	(+)	AC or (+)	(−) or AC	(−) or AC	(+)	AC or DC+	AC or −	AC or DC	AC or DC	AC or −
	2. Penetration at norm. curr.	High	Medium High	Medium Low	Medium Low	Medium High	Medium High	Medium	Low	Low	Medium High
●	3. Deposition rate at norm. curr.	Low	Low	Medium High	Medium	Medium	Medium	High	Very High	Very High	High
	4. Size of droplets Low amp.	Medium	Medium	Large	Large	Large	Large	Fine	Fine	Fine	Medium fine
	High amp.	Medium	Medium	Large	Large	Large	Large	Fine	Fine	Fine	Medium fine
★	5. Gaseous shield	High	High	Medium Low	Medium	Low	Low	Low	Low	Low	Low
	6. Rate of slag solidification	High	Medium High	Medium	Medium	Medium	Medium	Low	Medium	Low	Low
★	7. Normal bead shape	Flat	Flat to convex	Convex	Flat to convex	Flat to convex	Flat to convex	Flat to concave	Flat to convex	Flat to concave	Flat to concave
★	8. Freedom from porosity (x-ray)	Medium High	Medium High	Low	Medium	High	High	High	High	High	High
	9. Arc blow stability (dc)	High	Medium	High	Medium	Medium	Medium	Low	High	Low	Medium Low
★	10. Versatility (all position operation)	High	High	Medium	Medium High	Medium High	Medium High	Low	Low	Low	Low
●	11. Ease of slag removal Bulk	High	Medium	Medium High	High	Medium	Medium	High	High	High	High
	At Edge	Low	Low	Medium High	High	High	Medium	Medium	High	High	Medium
	12. Uniformity of bead from start to finish	High	High	Medium Low	Medium	High	High	High	High	High	High
	13. Freedom from undercutting	Low	Low	Medium High	High	Medium High	Medium High	Medium High	Medium	Medium	Medium
●	14. Freedom from cracking	Medium	Medium	High	Medium Low	High	High	Medium Low	High	Medium High	Medium
	15. Freedom from surface holes	Medium Low	Medium	High	Medium High	High	High	Medium	High	High	Medium Low
●	16. Freedom from spatter	Low	Low	Medium	High	Medium	Medium	High	High	High	Medium High
	17. Ease of operator training	Low	Low	Medium High	High	Medium	Medium	Medium	High	High	Medium
	18. Wash-in	Low	Low	Medium Low	Medium High	Medium	Medium	High	High	High	High
	19. Machine stability required	High	Medium	Medium	Low	High	Medium High	Medium	Medium	Medium	Medium
	20. Freedom from electrode sticking	Medium High	Medium High	Medium Low	Medium High	High	High	High	High	High	High
★	21. Freedom from slag interference	High	High	Medium High	Medium	Medium Low	Medium Low	Low	Low	Low	Low
	22. Volume of molten slag	Low	Low	Medium	Medium High	High	High	High	High	High	High
●	23. Weld appearance	Low	Low	Medium	Medium High	Medium Low	Medium Low	High	High	High	High

STEEL's

Arc Welding Electrode Buyers Guide

Here are the latest tradename designations for the five major categories of electrodes. There are many other special-purpose electrodes that have not been standardized by AWS and ASTM specifications. Consult the manufacturers for their application details

• *Extra copies of this article are available in quantities from one to three until supply is exhausted. Write Editorial Department,* STEEL, *Penton Bldg., Cleveland 13, O.*

STAINLESS STEEL

ASTM-AWS Specifications No.	Current	Air Reduction Sales Co.	Alloy Rods Co.	All-State Welding Alloys Co.	Arcos Corp.	Champion Rivet Co.	General Electric Co.	Harnischfeger Corp.	Hobart Bros. Co.
E-307-15	dc	.....	.....	.....	.....	.....	.....	AW3C-L	.....
E-307-16	ac or dc	.....	.....	.....	.....	.....	.....	AW3C-T	.....
E-308-15	dc	Airco 19-9	Arcoloy 308 Lime	.....	Chromend K	308-1	W-1308	Harstain 18-8 also in ELC	No. 308
E-308-16	ac or dc	Airco 19-9	Arcoloy 308 ac-dc	All-State No. 188	Stainlend K	308-2	W-2308	Harstain A18-8 also in ELC	No. 308 ac
E-309-15	dc	Airco 2512	Arcoloy 309 Lime	.....	Chromend HC	309-1	W-1309	Harstain 25-12	No. 309
E-309-16	ac or dc	Airco 25-12	Arcoloy 309 ac-dc	.....	Stainlend HC	309-2	W-2309	Harstain A25-12	No. 309 dc
E-310-15	dc	Airco 25-20	Arcoloy 310 Lime	.....	Chromend HCN	310-1	W-1310	Harstain 25-20	No. 310
E-310-16	ac or dc	Airco 25-20	Arcoloy 310 ac-dc	All-State No. 252	Stainlend HCN	310-2	W-2310	Harstain A25-20	No. 310 ac
E-316-15	dc	Airco 18-12 Mo	Arcoloy 316 Lime	.....	Chromend K Mo	316-1	W-1316	Harstain 18-8, 2 Mo also in ELC	No. 316
E-316-16	ac or dc	Airco 18-12 Mo	Arcoloy 316 ac-dc	.....	Stainlend K Mo	316-2	W-2316	Harstain A18-8, 2 Mo also in ELC	No. 316 ac
E-317-15	dc	Airco 18-12 3.5 Mo	Arcoloy 317 Lime	.....	Chromend 18/8 Mo	317-1	W-1317	Harstain 18-8, 3 Mo	.....
E-317-16	ac or dc	Airco 18-12 3.5 Mo	Arcoloy 317 ac-dc	.....	.....	317-2	W-2317	.....	.....
E-318-15	dc	.....	.....	.....	.....	.....	.....	.....	.....
E-330-15	dc	Airco 35 Ni 15 Cr	Arcoloy 330 Lime	.....	Chromend 15/35	330-1	W-1330	.....	.....
E-330-16	dc or ac	Airco 35 Ni 15 Cr	Arcoloy 330 ac-dc	.....	.....	330-2	W-2330	.....	.....
E-347-15	dc	Airco 19-9 Cb	Arcoloy 347 Lime	.....	Chromend 19/9 Cb	347-1	W-1347	Harstain 18-8, Cb	No. 347
E-347-16	dc or ac	Airco 19-9 Cb	Arcoloy 347 ac-dc	.....	Stainlend 19/9 Cb	347-2	W-2347	Harstain A18-8, Cb	No. 347 ac
E-410-15	dc	Airco 12 Cr	Arcoloy 410 Lime	.....	Chromend 12	410-1	W-1410	.....	.....
E-410-16	dc or ac	Airco 12 Cr	Arcoloy 410 ac-dc	.....	.....	410-2	W-2410	.....	.....
E-430-15	dc	Airco 16 Cr	Arcoloy 430 Lime	.....	Chromend 16	430-1	W-1430	.....	.....
E-430-16	dc or ac	.....	Arcoloy 430 ac-dc	.....	.....	430-2	.....	.....	.....
E-502-15	dc	Airco 4-6 Cr Mo	Arcoloy 502 Lime	.....	.....	Croloy 5 A	W-1502	.....	.....
E-502-16	dc or ac	.....	Arcoloy 502 ac-dc	.....	.....	502-2	W-2502	Harchrome 5	.....

ALUMINUM

ASTM-AWS Specification No.	Air Reduction Sales Co.	All-State Welding Alloys Co.	Arcos Corp.	Champion Rivet Co.	Hobart Bros. Co.	Lincoln Electric Co.	Marquette Mfg. Co.	Metal & Thermit Corp.	National Cylinder Gas Co.
A1-2	.....	All-State 28 Coated	Alumend 28	Type A1-2	.....	.....	.....	Murex Type A1-28	.....
	A1-43 Airco 57	All-State No. 32	Alumend 438	Type A1-43	Hobart Aluminum	Aluminum-weld	Marquette No. 70	Murex Type A1-43	Sureweld 1217-C

COPPER

ASTM-AWS Symbol	E-Cu	E-Cu Sn A	E-Cu Sn C	E-Cu Ni	E-Cu Si	E-Cu Al A	E-Cu Al B	E-Cu Al C	E-Cu Al D	E-Cu Al E
Air Reduction Sales Co.	.....	Airco 70	.....	.....	.....	Airco 100	Airco 116	Airco 120	Airco 125	Airco 130
Alloy Rods Co.	.....	.....	Bronze-Arc C	.....	.....	.....	.....	.....	.....	.....
All-State Welding Alloys Co.	.....	.....	All-State No. 24	.....	.....	.....	.....	.....	.....	.....
Ampco Metal Inc.	.....	.....	Phos-Trode	.....	.....	Ampco-Trode 10	Ampco-Trode 160	Ampco-Trode 200	Ampco-Trode 250	Ampco-Trode 300
Arcos Corp.	.....	.....	.....	Nicuend	.....	.....	.....	.....	.....	.....
Champion Rivet Co.	.....	.....	Bronze Devil	.....	.....	.....	.....	.....	.....	.....
Hobart Bros. Co.	.....	.....	Hobart Arcbronz	.....	.....	.....	.....	.....	.....	.....
Lincoln Electric Co.	.....	.....	Aerisweld	.....	.....	.....	.....	.....	.....	.....
Marquette Mfg. Co.	.....	.....	.....	.....	Marquette No. 61	.....	.....	.....	.....	.....
Metal & Thermit Corp.	.....	.....	Murex Pb-57	.....	.....	Murex Ab-12	Murex AB-16	Murex AB-20	Murex AB-25	Murex AB-30
National Cylinder Gas Co.	.....	Sureweld -20 Sureweld -22 Sureweld -20B	.....	.....	.....	.....	.....	.....	.....	.....
Reid-Avery Co.	.....	.....	Racolloy Phosphor-Bronze	.....	.....	.....	.....	.....	.....	.....

ASTM-AWS Specifications No.	Lincoln Electric Co.	Marquette Mfg. Co.	Maurath, Inc.	McKay Co.	Metal & Thermit Corp.	National Cylinder Gas Co.	Reid-Avery Co.	A. O. Smith Corp.	Westinghouse Electric Corp.
E-307-15	.....	.....	.....	.....	.....	.....	.....	SW 164	.....
E-307-16	.....	.....	.....	.....	.....	.....	.....	.....	.....
E-308-15	Stainweld A-5	.....	Maurath Type 308	McKay 18-8	Murex 19-9	Sureweld 308-15	Racolloy 18-8	SW 162 SW 262	308-15 Lime
E-308-16	Stainweld A-7	Marquette 308	Maurath Type 308	McKay 18-8	Murex Type 308	Sureweld 308-16	Racolloy 18-8 ac-dc	SW 362	308-16 Titania
E-309-15	Stainweld B-Cb	.....	Maurath Type 309	McKay 25-12	Murex 25-12	Sureweld 309-15	Racolloy 25-12	SW 166 SW 167	309-15 Lime
E-309-16	.....	Marquette 309	Maurath Type 309	McKay 25-12	Murex Type 309	Sureweld 309-16	Racolloy 25-12 ac-dc	.....	309-16 Titania
E-310-15	Stainweld D	.....	Maurath Type 310	McKay 25-20	Murex 25-20	Sureweld 310-15	Racolloy 2520	SW 159, SW 169, SW 168, SW 173	310-15 Lime
E-310-16	.....	Marquette 310	Maurath Type 310	McKay 25-20	Murex Type 310	Sureweld 310-16	Racolloy 2520 ac-dc	SW 359 SW 368	310-16 Titania
E-316-15	.....	.....	Maurath Type 316	McKay 18-8 Mo (316)	Murex 18-8 Mo	Sureweld 316-15	Racolloy 18-12	SW 160 SW 260	316-16 Lime
E-316-16	.....	Marquette 316	Maurath Type 316	McKay 18-8 Mo (316)	Murex Type 316	Sureweld 316-16	Racolloy 18-12 ac-dc	.....	316-16 Titania
E-317-15	.....	.....	Maurath Type 317	McKay 18-8 (317)	Murex 18-8 3 Mo	Sureweld 317-15	Racolloy 18-12	SW 161	317-15 Lime
E-317-16	.....	Marquette 317	Maurath Type 317	McKay 18-8 (317)	Murex Type 317	Sureweld 317-16	Racolloy 18-12 ac-dc	.....	317-16 Titania
E-318-15	Stainweld C-Cb	.....	.....	.....	.....	.....	.....	SW 158	.....
E-330-15	.....	.....	Maurath Type 330	McKay 15-35	Murex 15-35	Sureweld 330-15	Racolloy 15-35	.....	330-15 Lime
E-330-16	.....	Marquette 330	Maurath Type 330	McKay 15-35	Murex Type 330	Sureweld 330-16	Racolloy 15-35 ac-dc	.....	.....
E-347-15	Stainweld A5-Cb	.....	Maurath Type 347	McKay 18-8 Cb	Murex 19-9 Cb	Sureweld 347-15	Racolloy 18-8 Cb	SW 157	347-15 Lime
E-347-16	Stainweld A7-Cb	Marquette 347	Maurath Type 347	McKay 18-8 Cb	Murex Type 347	Sureweld 347-16	Racolloy 18-8 Cb, ac-dc	SW 357	347-16 Titania
E-410-15	.....	.....	Maurath Type 410	McKay 12 Cr	Murex 12 Cr	Sureweld 410-15	Racolloy 12 Cr-Mo	SW 153	410 Lime
E-410-16	.....	Marquette 410	Maurath Type 410	McKay 12 Cr	Murex Type 410	Sureweld 410-16	Racolloy 12 Cr-Mo, ac-dc	.....	410-16 Titania
E-430-15	.....	.....	Maurath Type 430	McKay 16 Cr	Murex 16 Cr	Sureweld 430-15	Racolloy 16 Cr	.....	430 Lime
E-430-16	.....	Marquette 430	Maurath Type 430	McKay 16 Cr	Murex Type 430	Sureweld 430-16	Racolloy 16 Cr, ac-dc	.....	430-16
E-502-15	.....	.....	Maurath Type 502	McKay 5 Cr-Mo	Murex 4-6 Cr	Sureweld 502-15	Racolloy 5 Cr-Mo	SW 151	502 Lime
E-502-16	.....	.....	Maurath Type 502	McKay 5 Cr-Mo	Murex Type 502	Sureweld 502-16	Racolloy 5 Cr-Mo ac-dc	.....	502-16 Titania

MILD STEEL

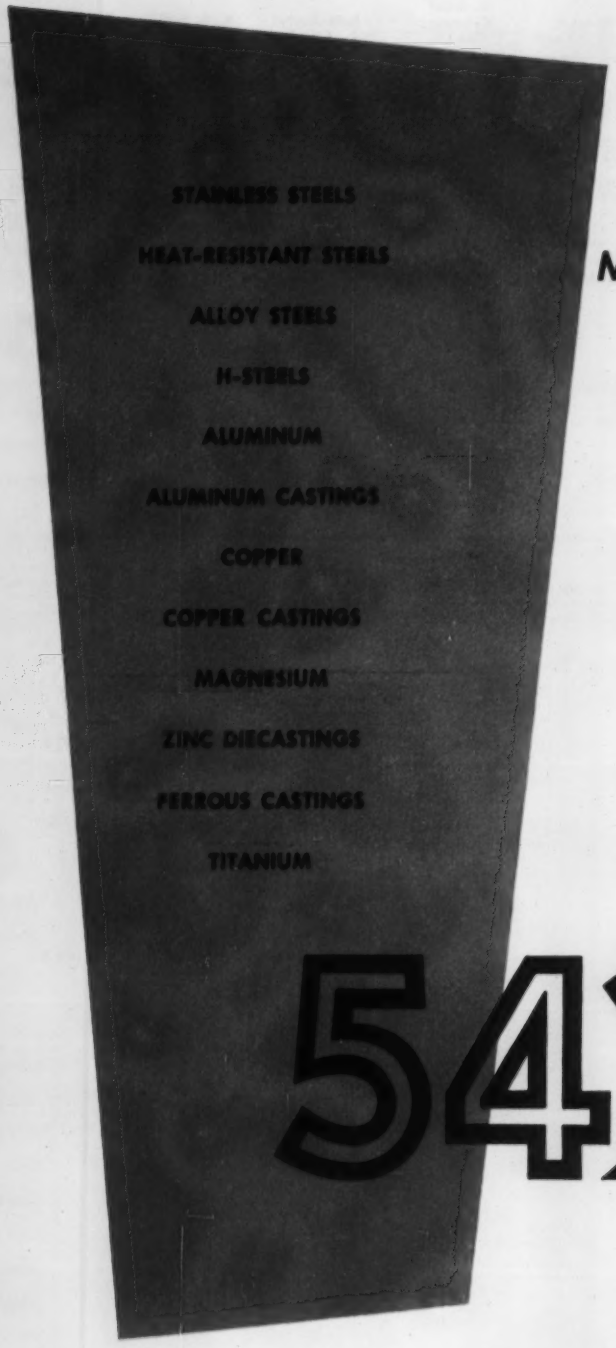
ASTM-AWS Specification No.	Electrode Coating	Welding Position	Air Reduction Sales Co.	Alloy Rods Co.	All-State Welding Alloys Co.	Champion Rivet Co.	General Electric Co.	Harnischfeger Corp.	Hobart Bros. Co.
E-4510	Sulcoated or Light Coated	F,V,OH,H	Airco 41, 63	.....	.....	Salcoat	F, L	Washcote	Sulkote
E-4520	Sulcoated or Light Coated	H-Fillets, F	.....	.....	.....	Speed #44	.....	.....	.....
E-6010	High Cellulose Sodium	F,V,OH,H	Airco 78 E	.....	All-State No. 613	Blue Devil	W-610A, B	AP, APV	No. 10
E-6011	High Cellulose Potassium	F,V,OH,H	Airco 230	.....	All-State No. 613	Bluedac	W-611A	AC-1	No. 335
E-6012	High Titania Sodium	F,V,OH,H	Airco 323, 387	.....	All-State No. 613	Gray Devil Gray Devil #2	W-612 A, B, G	PF, PFA	No. 12 No. 77
E-6013	High Titania Potassium	F,V,OH,H	Airco 90, 90A	.....	All-State No. 613	Graydac Tan Devil	W-613A	AC-3, 8M	No. 447 No. 313 No. 13
E-6014	High Titania (Iron Powder)	F,V,OH,H	.....	.....	.....	Speedemon 14	.....	DH-6	.....
E-6015	Low Hydrogen Sodium	F,V,OH,H	.....	.....	.....	.....	.....	.....	.....
E-6016	Low Hydrogen Potassium	F,V,OH,H	Airco 312	Atom Arc 7016 Iron Powder	.....	.....	W-616A	70LA-1	.....
E-6020	High Iron Oxide	H-Fillets, F	Airco 315, 306, 81	.....	.....	Black Devil	W-620 A, B, C	DH-2, DH-3	No. 111
E-6024	High Iron Oxide (Iron Powder)	H-Fillets, F	.....	.....	.....	Speedemon 24	Strikeasy 1	DH-5	"Rocket" 24
E-6027	High Iron Oxide (Iron Powder)	H-Fillets, F	.....	.....	.....	.....	.....	.....	"Rocket" 27
E-6030	High Iron Oxide	F	.....	.....	.....	Red Devil	.....	.....	.....

LOW ALLOY STEEL

ASTM-AWS Specification No.	Electrode Coating	Welding Position	Air Reduction Sales Co.	Alloy Rods Co.	All-State Welding Alloys Co.	Arcos Corp.	Champion Rivet Co.	General Electric Co.	Harnischfeger Corp.
E-7010	High Cellulose Sodium	F,V,OH,H	Airco 93	.....	.....	.....	Blue Devil 85	W-710A	CM-50
E-7011	High Cellulose Potassium	F,V,OH,H	Airco 382	.....	.....	.....	.....	W-711A	CM-50-1
E-7013	High Titania Potassium	F,V,OH,H	.....	.....	.....	.....	.....	.....	.....
E-7015	Low Hydrogen Sodium	F,V,OH,H	.....	.....	.....	.....	Croloy 1A	.....	.....
E-7016	Low Hydrogen Potassium	F,V,OH,H	Airco 327	Atom Arc 7016 Iron Powder	All-State No. 616	Tensilend 70	Hy-Lo	W-716B	70-LA-2 70LB P & H .25C DH-170 (Iron Powder)
E-7020	High Iron Oxide	H-Fillets, F	Airco 94	.....	.....	.....	Black Devil 75	W-720A	CM-50-2
E-8010	High Cellulose Sodium	F,V,OH,H	.....	.....	.....	.....	.....	.....	.....
E-8011	High Cellulose Potassium	F,V,OH,H	.....	.....	.....	.....	.....	.....	.....
E-8015	Low Hydrogen Sodium	F,V,OH,H	.....	.....	.....	.....	.....	.....	.....
E-8016	Low Hydrogen Potassium	F,V,OH,H	Airco 396, 354	Atom Arc 8016 N 8016 CM Iron Power	.....	Tensilend 80	.....	W-816A	P&H 8 75 LP
E-8016-B2	Low Hydrogen Potassium	F,V,OH,H	.....	.....	.....	Chromend 1 M	.....	.....	.....
E-8016-C1	Low Hydrogen Potassium	F,V,OH,H	.....	.....	.....	Nickend 2	.....	.....	.....
E-8016-C2	Low Hydrogen Potassium	F,V,OH,H	.....	.....	.....	Nickend 3	.....	.....	.....
E-8020	High Iron Oxide	H-Fillets, F	.....	.....	.....	.....	.....	.....	.....
E-9010	High Cellulose Sodium	F,V,OH,H	.....	.....	.....	.....	.....	.....	.....
E-9010-B2	High Cellulose Sodium	F,V,OH,H	.....	.....	.....	.....	.....	.....	.....
E-9011	High Cellulose Potassium	F,V,OH,H	.....	.....	.....	.....	.....	.....	.....
E-9013	High Titania Potassium	F,V,OH,H	.....	.....	.....	.....	.....	.....	.....
E-9015	Low Hydrogen Sodium	F,V,OH,H	.....	.....	.....	Manganend 1 M	Croloy 2A Croloy 2¼ A	.....	.....
E-9015-B3	Low Hydrogen Sodium	F,V,OH,H	.....	.....	.....	Chromend 2 M	.....	.....	.....
E-9016	Low Hydrogen Potassium	F,V,OH,H	Airco 351	Atom Arc 9016 CM Iron Powder	.....	.....	.....	W-916A	80 LE 90 LE AW 2B P&H 7 P&H .40C
E-9016-B3	Low Hydrogen Potassium	F,V,OH,H	.....	.....	.....	Chromend 2 MA	.....	.....	.....
E-10013	High Titania Potassium	F,V,OH,H	Airco 190	.....	.....	.....	Chromoloy 10u13	W-1013A	AW-4
E-10015	Low Hydrogen Sodium	F,V,OH,H	.....	.....	.....	.....	Hy-Lo 230-D	.....	.....
E-10016	Low Hydrogen Potassium	F,V,OH,H	Airco 394, 353	Atom Arc 10016 MM Iron Powder	.....	Tensilend 100	.....	W-1016A, B, C	P&H 12-2 90 LH-2
E-12015	Low Hydrogen Sodium	F,V,OH,H	Airco 352	.....	.....	Tensilend 120	.....	W-1215A	P&H 17-1
E-12016	Potassium	F,V,OH,H	.....	Atom Arc 12016 NMV Iron Powder	.....	.....	.....	.....	.....
E-12020	High Iron Oxide	H-Fillets, F	.....	.....	.....	.....	.....	.....	.....

ASTM-AWS Specification No.	Lincoln Electric Co.	Marquette Mfg. Co.	McKay Co.	Metal & Thermit Corp.	National Cylinder Gas Co.	Reid-Avery Co.	A. O. Smith Corp.	Westinghouse Electric Corp.
E-4510	Stable-Arc	Marquette 101	McKay 21	.....	Sureweld 30-S	RACO Blue Label	.....	Sulcoat 18
E-4520	.....	.....	McKay 3	.....	Sureweld 30XL	RACO Type D	.....	.....
E-6010	Fleetweld 5 Fleetweld 5p Lightweld	Marquette 105	McKay 15	Murex Type R	Sureweld B	RACO 7	SW 10	XL-610
E-6011	Fleetweld 180, 35	Marquette 130 Red-Rod	McKay 11	Murex Type A	Sureweld CB	RACO 11	SW 14	ACP
E-6012	Fleetweld 7, 72	Marquette 120	McKay 17, 116	Murex N-13, Murex Genex, Murex Genex M	Sureweld N, NM, G	RACO 8	SW 11, 12, 17	FP FP-2
E-6013	Fleetweld 47.37 Planeweld 2	Marquette 140, 151, 60, 13	McKay 24	Murex Alternex Murex Type U	Sureweld C, CE, CN	RACO 13	SW 15, 16	SW SW-2
E-6014	.....	.....	.....	.....	.....	.....	SW 46	.....
E-6015	Shield-Arc LH 70	.....	Pluralloy 70	.....	.....	RACO 6015	.....	.....
E-6016	Shield-Arc LH 70	.....	Pluralloy 70 AC	Murex Type HTS	.....	RACO 6016	SW 64, 65, 47	LOH-2
E-6020	Fleetweld 11	Marquette 115	McKay 16	Murex FHP Murex D	Sureweld FD	RACO 20	SW 35	DH
E-6024	Jetweld 1	Marquette 12	Comet-Arc	.....	.....	.....	SW 44	Zip-24 Iron Powder
E-6027	Jetweld 2	.....	.....	.....	.....	.....	SW 45	Zip-27 Iron Powder
E-6030	Fleetweld 11	.....	McKay 18	.....	.....	.....	.....	.....

ASTM-AWS Specification No.	Hobart Bros. Co.	Lincoln Electric Co.	Marquette Mfg. Co.	McKay Co.	Metal & Thermit Corp.	National Cylinder Gas Co.	Reid-Avery Co.	A. O. Smith Corp.	Westinghouse Electric Corp.
E-7010	No. 885	Shield-Arc 85 Shield-Arc 85P	.....	.....	Murex Molex	Sureweld MLY-50	RACO 74	SW 75, 80	AP-MO
E-7011	.....	.....	.....	.....	Murex Type MA	Sureweld MLY-C	RACO 7011	.....	ACP-MO
E-7013	.....	.....	.....	.....	.....	.....	.....	SW 85	.....
E-7015	.....	Shield-Arc LH 70	.....	Pluralloy 70	.....	.....	RACO 180-15	.....	.....
E-7016	No. 16	Shield-Arc LH 70	Marquette 7016, 7016N	Pluralloy 70 AC	Murex Type HTS-180 Type HTS-80	Sureweld 7016	RACO 180-16	SW 84	LOH-2
E-7020	No. 111HT	Jetweld 2HT Fleetweld 11HT	.....	.....	Murex Type DM	Sureweld MLY-A	RACO 64	SW 76	DH-MO
E-8010	.....	.....	.....	.....	.....	.....	.....	.....	.....
E-8011	.....	.....	Marquette 85	.....	.....	.....	.....	.....	.....
E-8015	.....	.....	.....	Pluralloy 3½% Ni	.....	.....	.....	.....	.....
E-8016	.....	.....	.....	.....	Murex Type 8016 Q	.....	RACO 8016	SW 79, 81	LOH-B-1
E-8016-B2	.....	.....	.....	.....	.....	.....	.....	.....	.....
E-8016-C1	.....	.....	.....	.....	.....	.....	.....	.....	.....
E-8016-C2	No. 816 N	.....	.....	.....	.....	.....	.....	.....	.....
E-8020	.....	.....	.....	.....	.....	.....	.....	.....	.....
E-9010	.....	.....	.....	.....	.....	.....	.....	SW 95	.....
E-9010-B2	.....	Shield-Arc 90 CM	.....	.....	.....	.....	.....	.....	.....
E-9011	.....	.....	.....	.....	Murex Type 2111	.....	.....	.....	.....
E-9013	.....	.....	.....	.....	.....	.....	.....	.....	.....
E-9015	.....	.....	.....	.....	.....	.....	.....	.....	.....
E-9015-B3	.....	.....	.....	.....	.....	.....	.....	.....	.....
E-9016	.....	.....	.....	.....	Murex Type 2116	Sureweld 9016	RACO 9016	SW 89, 90	LOH-B-2
E-9016-B3	No. 916 CM	.....	.....	.....	.....	.....	.....	.....	.....
E-10013	.....	Planeweld 1	Marquette 110	.....	.....	.....	RACO 10013	SW 88	.....
E-10015	.....	.....	.....	Pluralloy 100	.....	.....	RACO 230-15	.....	.....
E-10016	No. 1016 MM	.....	.....	Pluralloy 100 AC	Murex Type 4216 Type HTS 30 Type AWL	.....	RACO 230-16	SW 100	LOH-B-3
E-12015	.....	.....	.....	Pluralloy 120	Murex Type HTS-260	.....	RACO 260-15	.....	.....
E-12016	.....	.....	.....	.....	.....	.....	.....	SW 120 (dc only)	.....
E-12020	.....	.....	.....	.....	.....	.....	.....	SW 101	.....



Management and Materials

Cost-conscious management rates materials as important to profits as production and sales. No wonder. Materials can represent from 70 to 80 per cent of total product costs. Often they are the biggest single item of cost.

The question of selection is complicated by increasing competition among materials for practically any application. Management's interest in the over-all problem is clear. It must be assured that the right metals for the job are selected, specified and purchased in the most economical forms.

542 metals

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Metal Selector

Here is the practical information needed to help you select the right metal for the job

COPPER Wrought Alloys

Name	Nominal Composition[1]	Forms Used[2]	Machinability[3]	Applications
COPPERS:				
Electrolytic tough pitch	Cu 99.92; O 0.04	R,D,S,W,T	20	Radiators, electrical wire, flashing
Deoxidized	Cu 99.94; P 0.02	R,D,S,T	20	Plumbing, refrigeration, oil lines
Oxygen-free copper	Cu 99.92 min	R,D,S,W,T	20	Electronics, bus bar, radar
BRASSES—Nonleaded:				
Gilding, 95%	Cu 95; Zn 5	R,D,W	20	Medals, bullet jackets, jewelry
Commercial bronze, 90%	Cu 90; Zn 10	R,D,W,T	20	Door knobs, weather stripping, screen
Jewelry bronze, 87.5%	Cu 87.5; Zn 12.5	R,W	30	Slide fasteners, bead chain, plaques
Red brass, 85%	Cu 85; Zn 15	R,D,W,T	30	Fire extinguishers, compacts, plumbing
Low brass, 80%	Cu 80; Zn 20	R,D,W	30	Bellows, musical instruments, dials
Cartridge brass, 70%	Cu 70; Zn 30	R,D,W,T	30	Cartridge cases, springs, eyelets
Yellow brass	Cu 65; Zn 35	R,D,W	30	Lamp fixtures, hinges, screws
Muntz metal	Cu 60; Zn 40	R,D,W,T	40	Condenser plates, brazing rod, trim
LEADED BRASSES:				
Leaded commercial bronze	Cu 89; Pb 1.75; Zn 9.25	D,S	80	Electrical connectors, bolts, hardware
Low-leaded brass (tube)	Cu 66; Pb 0.5; Zn 33.5	T	60	Pump lines, primers, J-bends
Low-leaded brass	Cu 65; Pb 0.5; Zn 34.5	R	60	Sink strainers, butts, watch backs
Medium-leaded brass	Cu 65; Pb 1; Zn 34	R,D,S,W	70	Dials, clock plates, gears, nuts
High-leaded brass (tube)	Cu 66; Pb 1.6; Zn 32.4	T	80	Collars, large hex nuts, bushings
High-leaded brass	Cu 65; Pb 2.0; Zn 33.0	R,D	90	Nuts, gears, clock wheels
Extra-high-leaded brass	Cu 63; Pb 2.5; Zn 34.5	R	100	Nuts, gears, clock wheels
Free-cutting brass	Cu 61.5; Pb 3; Zn 35.5	D,S	100	Nuts, adaptors, gears, pinions
Leaded Muntz metal	Cu 60; Pb 0.6; Zn 39.4	R	60	Condenser tube plates, screening
Free-cutting Muntz metal (tube)	Cu 60; Pb 1; Zn 39	T	70	Collars, large hex nuts, bushings
Forging brass	Cu 60; Pb 2; Zn 38	R,D,S	80	Valve parts, door latches, refrigerator fittings
Architectural bronze	Cu 57; Pb 3; Zn 40	D,S	90	Extruded building trim and hardware
TIN & ALUMINUM BRASSES:				
Inhibited Admiralty	Cu 71; Zn 28; Sn 1	R,W,T	30	Condenser, heat exchanger tubes and plates
Naval brass	Cu 60; Zn 39.25; Sn 0.75	R,D,S,W,T	30	Valve stems, marine uses, propeller shafts
Leaded naval brass	Cu 60; Pb 1.75; Zn 37.5; Sn 0.75	D,S	70	Bolts, nuts, valve parts
Manganese bronze	Cu 58.5; Fe 1; Zn 39.2; Sn 1; Mn 0.3	R,D,S,W	30	Welding rods, pump rods, valve bodies
Aluminum brass	Cu 76; Zn 22; Al 2	T	30	Condenser, heat exchanger tubes
Aluminum bronze, 5%	Cu 95; Al 5	T	20	Condenser, heat exchanger tubes
PHOSPHOR BRONZES (Tin Bronzes):				
Phosphor bronze, 5%	Cu 95; Sn 5	R,D,W,T	20	Bellows, welding rod, electrical switch parts
Phosphor bronze, 8%	Cu 92; Sn 8	R,D,W	20	Electrical switch parts, bushings, springs
Phosphor bronze, 10%	Cu 90; Sn 10	R,D,W	20	Bridge plates, heater bars, springs
Phosphor bronze, 1.25%	Cu 98.75; Sn 1.25; P trace	R	20	Electrical contacts, flexible hose, pole-line hardware
Free-cutting Phosphor Bronze	Cu 88; Pb 4; Zn 4; Sn 4	R,D	80	Bearings, bushings, valve parts
CUPRO-NICKEL & NICKEL SILVERS:				
Cupro-nickel, 30%	Cu 70; Ni 30	R,D,T	20	Condenser and salt water tubing
Cupro-nickel, 10%	Cu 88.7; Fe 1.3; Ni 10	R,T	20	Condenser and salt water tubing
Nickel silver, 65-18	Cu 65; Zn 17; Ni 18	R,D,W	20	Flatware, zippers, hollow ware
Nickel silver, 55-18	Cu 55; Zn 27; Ni 18	R,D,W	30	Electrical springs, diaphragms, electronics
Nickel silver, 65-15	Cu 65; Zn 20; Ni 15	R	20	Camera parts, costume jewelry, name plates
Nickel silver, 65-12	Cu 65; Zn 23; Ni 12	R,W	20	Etching stock, slide fasteners, hollow ware
Nickel silver, 65-10	Cu 65; Zn 25; Ni 10	R,W	20	Screws, flatware, platers' bars
SILICON BRONZES (Copper-Silicon Alloys):				
High-silicon bronze	Cu 96; Si 3	R,D,S,W,T	30	Screws, bolts, pole-line hardware
Low-silicon bronze	Cu 97.7; Si 1.5	R,D,S,W,T	30	Bolts, screws, nuts, rivets

1. Only major elements listed

2. Abbreviations:
R—rolled flat products
D—rod and drawn flat products
S—shapes
W—wire (except flat)
T—tube

3. Basis: Free-cutting brass = 100

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ALLOY STEELS

Chemical Composition Ranges and Limits Include Standard, Tentative Standard (TS) and Boron H-Steels

AISI Number	C	Mn	P Max	S Max	Si	Ni	Cr	Mo
1330	0.28–0.33	1.60–1.90	0.040	0.040	0.20–0.35	.....	.....	.....
1335	0.33–0.38	1.60–1.90	0.040	0.040	0.20–0.35	.....	.....	.....
1340	0.38–0.43	1.60–1.90	0.040	0.040	0.20–0.35	.....	.....	.....
1345	0.43–0.48	1.60–1.90	0.040	0.040	0.20–0.35	.....	.....	.....
TS 14B35	0.33–0.38	0.75–1.00	....	....	0.20–0.35	.....	.....	.....
TS 14B50	0.48–0.53	0.75–1.00	....	....	0.20–0.35	.....	.....	.....
2317	0.15–0.20	0.40–0.60	0.040	0.040	0.20–0.35	3.25–3.75	.....	.....
2515	0.12–0.17	0.40–0.60	0.040	0.040	0.20–0.35	4.75–5.25	.....	.....
E2517	0.15–0.20	0.45–0.60	0.025	0.025	0.20–0.35	4.75–5.25	.....	.....
3120	0.17–0.22	0.60–0.80	0.040	0.040	0.20–0.35	1.10–1.40	0.55–0.75	.....
3130	0.28–0.33	0.60–0.80	0.040	0.040	0.20–0.35	1.10–1.40	0.55–0.75	.....
3135	0.33–0.38	0.60–0.80	0.040	0.040	0.20–0.35	1.10–1.40	0.55–0.75	.....
3140	0.38–0.43	0.70–0.90	0.040	0.040	0.20–0.35	1.10–1.40	0.55–0.75	.....
E3310	0.08–0.13	0.45–0.60	0.025	0.025	0.20–0.35	3.25–3.75	1.40–1.75	.....
E3316	0.14–0.19	0.45–0.60	0.025	0.025	0.20–0.35	3.25–3.75	1.40–1.75	.....
4023	0.20–0.25	0.70–0.90	0.040	0.040	0.20–0.35	.....	.....	0.20–0.30
4024	0.20–0.25	0.70–0.90	0.040	0.035–0.050	0.20–0.35	.....	.....	0.20–0.30
4027	0.25–0.30	0.70–0.90	0.040	0.040	0.20–0.35	.....	.....	0.20–0.30
4028	0.25–0.30	0.70–0.90	0.040	0.035–0.050	0.20–0.35	.....	.....	0.20–0.30
4032	0.30–0.35	0.70–0.90	0.040	0.040	0.20–0.35	.....	.....	0.20–0.30
4037	0.35–0.40	0.70–0.90	0.040	0.040	0.20–0.35	.....	.....	0.20–0.30
4042	0.40–0.45	0.70–0.90	0.040	0.040	0.20–0.35	.....	.....	0.20–0.30
4047	0.45–0.50	0.70–0.90	0.040	0.040	0.20–0.35	.....	.....	0.20–0.30
4053	0.50–0.56	0.75–1.00	0.040	0.040	0.20–0.35	.....	.....	0.20–0.30
4063	0.60–0.67	0.75–1.00	0.040	0.040	0.20–0.35	.....	.....	0.20–0.30
4068	0.63–0.70	0.75–1.00	0.040	0.040	0.20–0.35	.....	.....	0.20–0.30
4118	0.18–0.23	0.70–0.90	0.040	0.040	0.20–0.35	.....	0.40–0.60	0.08–0.15
4130	0.28–0.33	0.40–0.60	0.040	0.040	0.20–0.35	.....	0.80–1.10	0.15–0.25
TS 4130	0.28–0.33	0.45–0.65	....	....	0.20–0.35	.....	0.90–1.20	0.08–0.15
TS 4132	0.30–0.35	0.45–0.65	....	....	0.20–0.35	.....	0.90–1.20	0.08–0.15
4135	0.33–0.38	0.70–0.90	0.040	0.040	0.20–0.35	.....	0.80–1.10	0.15–0.25
4137	0.35–0.40	0.70–0.90	0.040	0.040	0.20–0.35	.....	0.80–1.10	0.15–0.25
TS 4137	0.35–0.40	0.75–1.00	....	....	0.20–0.35	.....	0.90–1.20	0.08–0.15
4140	0.38–0.43	0.75–1.00	0.040	0.040	0.20–0.35	.....	0.80–1.10	0.15–0.25
TS 4140	0.38–0.43	0.80–1.05	....	....	0.20–0.35	.....	0.90–1.20	0.08–0.15
4142	0.40–0.45	0.75–1.00	0.040	0.040	0.20–0.35	.....	0.80–1.10	0.15–0.25
TS 4142	0.40–0.45	0.80–1.05	....	....	0.20–0.35	.....	0.90–1.20	0.08–0.15
4145	0.43–0.48	0.75–1.00	0.040	0.040	0.20–0.35	.....	0.80–1.10	0.15–0.25
TS 4145	0.43–0.48	0.80–1.05	....	....	0.20–0.35	.....	0.90–1.20	0.08–0.15
4147	0.45–0.50	0.75–1.00	0.040	0.040	0.20–0.35	.....	0.80–1.10	0.15–0.25
4150	0.48–0.53	0.75–1.00	0.040	0.040	0.20–0.35	.....	0.80–1.10	0.15–0.25
TS 4150	0.48–0.53	0.80–1.05	....	....	0.20–0.35	.....	0.90–1.20	0.08–0.15
TS 43BV12	0.08–0.13	0.75–1.00	....	0.03 min V	0.20–0.40	1.65–2.00	0.40–0.60	0.20–0.30
TS 43BV14	0.10–0.15	0.45–0.65	....	0.03 min S	0.20–0.35	1.65–2.00	0.40–0.60	0.08–0.15
4320	0.17–0.22	0.45–0.65	0.040	0.040	0.20–0.35	1.65–2.00	0.40–0.60	0.20–0.30
4337	0.35–0.40	0.60–0.80	0.040	0.040	0.20–0.35	1.65–2.00	0.70–0.90	0.20–0.30
E4337	0.35–0.40	0.65–0.85	0.025	0.025	0.20–0.35	1.65–2.00	0.70–0.90	0.20–0.30
4340	0.38–0.43	0.60–0.80	0.040	0.040	0.20–0.35	1.65–2.00	0.70–0.90	0.20–0.30
E4340	0.38–0.43	0.65–0.85	0.025	0.025	0.20–0.35	1.65–2.00	0.70–0.90	0.20–0.30
4608	0.06–0.11	0.25–0.45	0.040	0.040	0.25 max	1.40–1.75	.....	0.15–0.25
46B12	0.10–0.15	0.45–0.65	0.040	0.040	0.20–0.35	1.65–2.00	.....	0.20–0.30
4615	0.13–0.18	0.45–0.65	0.040	0.040	0.20–0.35	1.65–2.00	.....	0.20–0.30
4617	0.15–0.20	0.45–0.65	0.040	0.040	0.20–0.35	1.65–2.00	.....	0.20–0.30
4620	0.17–0.22	0.45–0.65	0.040	0.040	0.20–0.35	1.65–2.00	.....	0.20–0.30
X4620	0.18–0.23	0.50–0.70	0.040	0.040	0.20–0.35	1.65–2.00	.....	0.20–0.30
4621	0.18–0.23	0.70–0.90	0.040	0.040	0.20–0.35	1.65–2.00	.....	0.20–0.30
4640	0.38–0.43	0.60–0.80	0.040	0.040	0.20–0.35	1.65–2.00	.....	0.20–0.30
4720	0.17–0.22	0.50–0.70	0.040	0.040	0.20–0.35	0.90–1.20	0.35–0.55	0.15–0.25
4812	0.10–0.15	0.40–0.60	0.040	0.040	0.20–0.35	3.25–3.75	.....	0.20–0.30
4815	0.13–0.18	0.40–0.60	0.040	0.040	0.20–0.35	3.25–3.75	.....	0.20–0.30
4817	0.15–0.20	0.40–0.60	0.040	0.040	0.20–0.35	3.25–3.75	.....	0.20–0.30
4820	0.18–0.23	0.50–0.70	0.040	0.040	0.20–0.35	3.25–3.75	.....	0.20–0.30
5015	0.12–0.17	0.30–0.50	0.040	0.040	0.20–0.35	.....	0.30–0.50	.....
50B30 alt.	0.27–0.34	0.70–1.00	....	....	0.20–0.35	.....	0.35–0.60	.....
50B35 alt.	0.32–0.39	0.70–1.00	....	....	0.20–0.35	.....	0.35–0.60	.....
50B40 alt.	0.37–0.45	0.70–1.00	....	....	0.20–0.35	.....	0.35–0.60	.....
50B44 alt.	0.42–0.50	0.70–1.00	....	....	0.20–0.35	.....	0.35–0.60	.....
5046	0.43–0.50	0.75–1.00	0.040	0.040	0.20–0.35	.....	0.20–0.35	.....
50B46	0.43–0.50	0.75–1.00	0.040	0.040	0.20–0.35	.....	0.20–0.35	.....
50B50	0.48–0.53	0.75–1.00	0.040	0.040	0.20–0.35	.....	0.40–0.60	.....
50B60	0.55–0.65	0.75–1.00	0.040	0.040	0.20–0.35	.....	0.40–0.60	.....
5117	0.15–0.20	0.70–0.90	0.040	0.040	0.20–0.35	.....	0.70–0.90	.....
5120	0.17–0.22	0.70–0.90	0.040	0.040	0.20–0.35	.....	0.70–0.90	.....
5130	0.28–0.33	0.70–0.90	0.040	0.040	0.20–0.35	.....	0.80–1.10	.....
5132	0.30–0.35	0.60–0.80	0.040	0.040	0.20–0.35	.....	0.75–1.00	.....
5135	0.33–0.38	0.60–0.80	0.040	0.040	0.20–0.35	.....	0.80–1.05	.....
5140	0.38–0.43	0.70–0.90	0.040	0.040	0.20–0.35	.....	0.70–0.90	.....
5145	0.43–0.48	0.70–0.90	0.040	0.040	0.20–0.35	.....	0.70–0.90	.....
5147	0.45–0.52	0.70–0.95	0.040	0.040	0.20–0.35	.....	0.85–1.15	.....
5150	0.48–0.53	0.70–0.90	0.040	0.040	0.20–0.35	.....	0.70–0.90	.....
5152	0.48–0.55	0.70–0.90	0.040	0.040	0.20–0.35	.....	0.90–1.20	.....
5155	0.50–0.60	0.70–0.90	0.040	0.040	0.20–0.35	.....	0.70–0.90	.....
5160	0.55–0.65	0.75–1.00	0.040	0.040	0.20–0.35	.....	0.70–0.90	.....
51B60	0.55–0.65	0.75–1.00	0.040	0.040	0.20–0.35	.....	0.70–0.90	.....
E50100	0.95–1.10	0.25–0.45	0.025	0.025	0.20–0.35	.....	0.40–0.60	.....
E51100	0.95–1.10	0.25–0.45	0.025	0.025	0.20–0.35	.....	0.90–1.15	.....
E52100	0.95–1.10	0.25–0.45	0.025	0.025	0.20–0.35	.....	1.30–1.60	.....
6117	0.15–0.20	0.70–0.90	0.040	0.040	0.20–0.35	.....	0.70–0.90	V 0.10 min
6120	0.17–0.22	0.70–0.90	0.040	0.040	0.20–0.35	.....	0.70–0.90	0.10 min
6145	0.43–0.48	0.70–0.90	0.040	0.040	0.20–0.35	.....	0.80–1.10	0.15 min
6150	0.48–0.53	0.70–0.90	0.040	0.040	0.20–0.35	.....	0.80–1.10	0.15 min

AISI Number	C	Mn	P Max	S Max	Si	Ni	Cr
TS 8115	0.13–0.18	0.70–0.90	....	....	0.20–0.35	0.20–0.40	0.30–0.50
TS 8120	0.18–0.23	0.70–0.90	....	....	0.20–0.35	0.20–0.40	0.30–0.50
TS 8122	0.20–0.25	0.70–0.90	....	....	0.20–0.35	0.20–0.40	0.30–0.50
TS 8125	0.23–0.28	0.70–0.90	....	....	0.20–0.35	0.20–0.40	0.30–0.50
TS 8127	0.25–0.30	0.70–0.90	....	....	0.20–0.35	0.20–0.40	0.30–0.50
81B45	0.43–0.48	0.75–1.00	0.040	0.040	0.20–0.35	0.20–0.40	0.35–0.55
8615	0.13–0.18	0.70–0.90	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
TS 8615	0.13–0.18	0.70–0.90	....	....	0.20–0.35	0.30–0.60	0.55–0.75
8617	0.15–0.20	0.70–0.90	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
TS 8617	0.15–0.20	0.70–0.90	....	....	0.20–0.35	0.30–0.60	0.55–0.75
8620	0.18–0.23	0.70–0.90	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
TS 8620	0.18–0.23	0.70–0.90	....	....	0.20–0.35	0.30–0.60	0.55–0.75
8622	0.20–0.25	0.70–0.90	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
8625	0.23–0.28	0.70–0.90	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
8627	0.25–0.30	0.70–0.90	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
8630	0.28–0.33	0.70–0.90	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
8635	0.33–0.38	0.75–1.00	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
8637	0.35–0.40	0.75–1.00	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
8640	0.38–0.43	0.75–1.00	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
8641	0.38–0.43	0.75–1.00	0.040	0.040–0.060	0.20–0.35	0.40–0.70	0.40–0.60
8642	0.40–0.45	0.75–1.00	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
8645	0.43–0.48	0.75–1.00	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
86B45	0.43–0.48	0.75–1.00	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
8650	0.48–0.53	0.75–1.00	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
8653	0.50–0.56	0.75–1.00	0.040	0.040	0.20–0.35	0.40–0.70	0.50–0.80
8655	0.50–0.60	0.75–1.00	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
8660	0.55–0.65	0.75–1.00	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
8715	0.13–0.18	0.70–0.90	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
8717	0.15–0.20	0.70–0.90	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
8720	0.18–0.23	0.70–0.90	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
8735	0.33–0.38	0.75–1.00	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
8740	0.38–0.43	0.75–1.00	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
8742	0.40–0.45	0.75–1.00	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
8750	0.48–0.53	0.75–1.00	0.040	0.040	0.20–0.35	0.40–0.70	0.40–0.60
9255	0.50–0.60	0.70–0.95	0.040	0.040	1.80–2.20	.....	.....
9260	0.55–0.65	0.70–1.00	0.040	0.040	1.80–2.20	.....	.....
9261	0.55–0.65	0.75–1.00	0.040	0.040	1.80–2.20	.....	0.10–0.25
9262	0.55–0.65	0.75–1.00	0.040	0.040	1.80–2.20	.....	0.25–0.40
E9310	0.08–0.13	0.45–0.65	0.025	0.025	0.20–0.35	3.00–3.50	1.00–1.40
E9314	0.11–0.17	0.40–0.70	0.025	0.025	0.20–0.35	3.00–3.50	1.00–1.40
94B15	0.13–0.18	0.75–1.00	0.040	0.040	0.20–0.35	0.30–0.60	0.30–0.50
94B17	0.15–0.20	0.75–1.00	0.040	0.040	0.20–0.35	0.30–0.60	0.30–0.50
TS 94B30	0.28–0.33	0.75–1.00	....	....	0.20–0.35	0.30–0.60	0.30–0.50
TS 94B40	0.38–0.43	0.75–1.00	....	....	0.20–0.35	0.30–0.60	0.30–0.50
9840	0.38–0.43	0.70–0.90	0.040	0.040	0.20–0.35	0.85–1.15	0.70–0.90
9845	0.43–0.48	0.70–0.90	0.040	0.040	0.20–0.35	0.85–1.15	0.70–0.90
9850	0.48–0.53	0.70–0.90	0.040	0.040	0.20–0.35	0.85–1.15	0.70–0.90

Source—American Iron & Steel Institute, 1955

NOTES

1. TS denotes tentative standard steels
2. Boron steels indicated by B can be expected to have 0.0005 per cent minimum boron content
3. Grades with prefix E are manufactured by basic electric furnace process. All others are normally produced by the basic open-hearth process but may be made by the basic electric furnace process with adjustments in phosphorus and sulphur
4. Ranges and limits apply to steel not exceeding 200 sq in. cross-sectional area
5. Compositions apply to following products: Hot-rolled and cold-finished steel bars; semifinished steel products for forging; hot-rolled and cold-rolled sheets; hot-rolled and cold-rolled strip; mechanical tubing can be supplied in certain alloy compositions subject to negotiation
6. The phosphorus and sulphur limitations process are as follows:
   Basic electric furnace 0.0
   Basic open hearth 0.0
   Acid electric furnace 0.0
   Acid open hearth 0.0
7. Minimum silicon limit for acid open heart electric furnace alloy steel is 0.15 per ce
8. Small quantities of certain elements are p alloy steel which are not specified or These elements are considered as incide may be present to the following amounts: Copper, 0.35 per cent; nick chromium, 0.20; molybdenum, 0.06
9. Where minimum and maximum sulphur shown, it is indicative of resulphurized st

ZINC Diecasting Alloys

ASTM, SAE Number and Commercial Name	Composition Limits (Ingot) ASTM B240 Tentative Specification	Outstanding Property	Typical Applications
AG40A SAE-903 Zamak-3	Cu 0.10 max; Al 3.9–4.3; Mg 0.03–0.06; Fe 0.075 max; Pb 0.005 max; Cd 0.004 max; Sn 0.002 max	Retention of impact strength and dimensions	Carburetors, fuel pump erator hardware, wash chines, parking meters, and any of below
AC41A SAE-925 Zamak-5	Cu 0.75–1.25; Al 3.9–4.3; Mg 0.03–0.06; Fe 0.075 max; Pb 0.005 max; Cd 0.004 max; Sn 0.002 max	Greater hardness and tensile strength	Business machines, gea hardware, lawn mowe small tools and any of

H-STEELS

Chemical Composition Ranges and Limits Include Standard, Tentative Standard (TS) and Boron H-Steels

SAE or AISI NUMBER	C	Mn	Si	Ni	Cr	Mo
1350-H	0.27–0.33	1.45–2.05	0.20–0.35	.....	.....	.....
1355-H	0.32–0.38	1.45–2.05	0.20–0.35	.....	.....	.....
1340-H	0.37–0.44	1.45–2.05	0.20–0.35	.....	.....	.....
TS 14B35-H	0.32–0.38	0.65–1.10	0.20–0.35	.....	.....	.....
TS 14B50-H	0.47–0.54	0.65–1.10	0.20–0.35	.....	.....	.....
2515-H	0.12–0.18	0.30–0.70	0.20–0.35	4.70–5.30	.....	.....
2517-H	0.14–0.20	0.30–0.70	0.20–0.35	4.70–5.30	.....	.....
3120-H	0.17–0.23	0.50–0.90	0.20–0.35	1.00–1.45	0.45–0.85	.....
3130-H	0.27–0.33	0.50–0.90	0.20–0.35	1.00–1.45	0.45–0.85	.....
3135-H	0.32–0.38	0.50–0.90	0.20–0.35	1.00–1.45	0.45–0.85	.....
3140-H	0.37–0.44	0.60–1.00	0.20–0.35	1.00–1.45	0.45–0.85	.....
3310-H	0.07–0.13	0.30–0.70	0.20–0.35	3.20–3.80	1.30–1.80	.....
3316-H	0.13–0.19	0.30–0.70	0.20–0.35	3.20–3.80	1.30–1.80	.....
4032-H	0.29–0.35	0.60–1.00	0.20–0.35	.....	.....	0.20–0.30
4037-H	0.34–0.41	0.60–1.00	0.20–0.35	.....	.....	0.20–0.30
4042-H	0.39–0.46	0.60–1.00	0.20–0.35	.....	.....	0.20–0.30
4047-H	0.44–0.51	0.60–1.00	0.20–0.35	.....	.....	0.20–0.30
4053-H	0.49–0.56	0.65–1.10	0.20–0.35	.....	.....	0.20–0.30
4063-H	0.59–0.69	0.65–1.10	0.20–0.35	.....	.....	0.20–0.30
4068-H	0.62–0.72	0.65–1.10	0.20–0.35	.....	.....	0.20–0.30
4118-H	0.17–0.23	0.60–1.00	0.20–0.35	.....	0.30–0.70	0.08–0.15
4130-H	0.27–0.33	0.30–0.70	0.20–0.35	.....	0.75–1.20	0.15–0.25
TS 4130-H	0.27–0.33	0.35–0.75	0.20–0.35	.....	0.85–1.30	0.08–0.15
TS 4132-H	0.29–0.35	0.35–0.75	0.20–0.35	.....	0.85–1.30	0.08–0.15
4135-H	0.32–0.38	0.60–1.00	0.20–0.35	.....	0.75–1.20	0.15–0.25
4137-H	0.34–0.41	0.60–1.00	0.20–0.35	.....	0.75–1.20	0.15–0.25
TS 4137-H	0.34–0.41	0.65–1.10	0.20–0.35	.....	0.85–1.30	0.08–0.15
4140-H	0.37–0.44	0.65–1.10	0.20–0.35	.....	0.75–1.20	0.15–0.25
TS 4140-H	0.37–0.44	0.70–1.20	0.20–0.35	.....	0.85–1.30	0.08–0.15
4142-H	0.39–0.46	0.65–1.10	0.20–0.35	.....	0.75–1.20	0.15–0.25
TS 4142-H	0.39–0.46	0.70–1.20	0.20–0.35	.....	0.85–1.30	0.08–0.15
4145-H	0.42–0.49	0.65–1.10	0.20–0.35	.....	0.75–1.20	0.15–0.25
TS 4145-H	0.42–0.49	0.70–1.20	0.20–0.35	.....	0.85–1.30	0.08–0.15
4147-H	0.44–0.51	0.65–1.10	0.20–0.35	.....	0.75–1.20	0.15–0.25
4150-H	0.47–0.54	0.65–1.10	0.20–0.35	.....	0.75–1.20	0.15–0.25
TS 4150-H	0.47–0.54	0.70–1.20	0.20–0.35	.....	0.85–1.30	0.08–0.15
4320-H	0.17–0.23	0.40–0.70	0.20–0.35	1.55–2.00	0.35–0.65	0.20–0.30
4337-H	0.34–0.41	0.55–0.90	0.20–0.35	1.55–2.00	0.65–0.95	0.20–0.30
4340-H	0.37–0.44	0.55–0.90	0.20–0.35	1.55–2.00	0.65–0.95	0.20–0.30
E4340-H	0.37–0.44	0.60–0.95	0.20–0.35	1.55–2.00	0.65–0.95	0.20–0.30
46B12-H	0.09–0.15	0.35–0.75	0.20–0.35	1.55–2.00	.....	0.20–0.30
4620-H	0.17–0.23	0.35–0.75	0.20–0.35	1.55–2.00	.....	0.20–0.30
X4620-H	0.17–0.23	0.40–0.80	0.20–0.35	1.55–2.00	.....	0.20–0.30
4621-H	0.17–0.23	0.60–1.00	0.20–0.35	1.55–2.00	.....	0.20–0.30
4640-H	0.37–0.44	0.50–0.90	0.20–0.35	1.55–2.00	.....	0.20–0.30
4720-H	0.17–0.23	0.45–0.75	0.20–0.35	0.85–1.25	0.30–0.60	0.15–0.25
4812-H	0.09–0.15	0.30–0.70	0.20–0.35	3.20–3.80	.....	0.20–0.30
4815-H	0.12–0.18	0.30–0.70	0.20–0.35	3.20–3.80	.....	0.20–0.30
4817-H	0.14–0.20	0.30–0.70	0.20–0.35	3.20–3.80	.....	0.20–0.30
4820-H	0.17–0.23	0.40–0.80	0.20–0.35	3.20–3.80	.....	0.20–0.30
5046-H	0.43–0.50	0.65–1.10	0.20–0.35	.....	0.13–0.43	.....
50B46-H	0.43–0.50	0.65–1.10	0.20–0.35	.....	0.13–0.43	.....
50B60-H	0.55–0.65	0.65–1.10	0.20–0.35	.....	0.30–0.70	.....
5120-H	0.17–0.23	0.60–1.00	0.20–0.35	.....	0.60–1.00	.....
5130-H	0.27–0.33	0.60–1.00	0.20–0.35	.....	0.75–1.20	.....
5132-H	0.29–0.35	0.50–0.90	0.20–0.35	.....	0.65–1.10	.....
5135-H	0.32–0.38	0.50–0.90	0.20–0.35	.....	0.70–1.15	.....
5140-H	0.37–0.44	0.60–1.00	0.20–0.35	.....	0.60–1.00	.....
5145-H	0.42–0.49	0.60–1.00	0.20–0.35	.....	0.60–1.00	.....
5147-H	0.45–0.52	0.60–1.05	0.20–0.35	.....	0.80–1.25	.....
5150-H	0.47–0.54	0.60–1.00	0.20–0.35	.....	0.60–1.00	.....
5152-H	0.48–0.55	0.60–1.00	0.20–0.35	.....	0.85–1.30	.....
5160-H	0.55–0.65	0.65–1.10	0.20–0.35	.....	0.60–1.00	.....
51B60-H	0.55–0.65	0.65–1.10	0.20–0.35	.....	0.60–1.00	.....
						V
6120-H	0.17–0.23	0.60–1.00	0.20–0.35	.....	0.60–1.00	0.10 min
6145-H	0.42–0.49	0.60–1.00	0.20–0.35	.....	0.75–1.20	0.15 min
6150-H	0.47–0.54	0.60–1.00	0.20–0.35	.....	0.75–1.20	0.15 min
						Mo
TS 8122-H	0.19–0.25	0.60–0.95	0.20–0.35	0.15–0.45	0.25–0.55	0.08–0.15
81B45-H	0.42–0.49	0.70–1.05	0.20–0.35	0.15–0.45	0.30–0.60	0.08–0.15
8617-H	0.14–0.20	0.60–0.95	0.20–0.35	0.35–0.75	0.35–0.65	0.15–0.25
TS 8617-H	0.14–0.20	0.60–0.95	0.20–0.35	0.25–0.65	0.50–0.80	0.08–0.15
8620-H	0.17–0.23	0.60–0.95	0.20–0.35	0.35–0.75	0.35–0.65	0.15–0.25
TS 8620-H	0.17–0.23	0.60–0.95	0.20–0.35	0.25–0.65	0.50–0.80	0.08–0.15
8622-H	0.19–0.25	0.60–0.95	0.20–0.35	0.35–0.75	0.35–0.65	0.15–0.25
8625-H	0.22–0.28	0.60–0.95	0.20–0.35	0.35–0.75	0.35–0.65	0.15–0.25
8627-H	0.24–0.30	0.60–0.95	0.20–0.35	0.35–0.75	0.35–0.65	0.15–0.25
8630-H	0.27–0.33	0.60–0.95	0.20–0.35	0.35–0.75	0.35–0.65	0.15–0.25
8635-H	0.32–0.38	0.70–1.05	0.20–0.35	0.35–0.75	0.35–0.65	0.15–0.25
8637-H	0.34–0.41	0.70–1.05	0.20–0.35	0.35–0.75	0.35–0.65	0.15–0.25
8640-H	0.37–0.44	0.70–1.05	0.20–0.35	0.35–0.75	0.35–0.65	0.15–0.25
8641-H*	0.37–0.44	0.70–1.05	0.20–0.35	0.35–0.75	0.35–0.85	0.15–0.25
8642-H	0.39–0.46	0.70–1.05	0.20–0.35	0.35–0.75	0.35–0.65	0.15–0.25
8645-H	0.42–0.49	0.70–1.05	0.20–0.35	0.35–0.75	0.35–0.65	0.15–0.25
86B45-H	0.42–0.49	0.70–1.05	0.20–0.35	0.35–0.75	0.35–0.65	0.15–0.25
8650-H	0.47–0.54	0.70–1.05	0.20–0.35	0.35–0.75	0.35–0.65	0.15–0.25
8653-H	0.49–0.56	0.70–1.05	0.20–0.35	0.35–0.75	0.50–0.85	0.15–0.25
8655-H	0.50–0.60	0.70–1.05	0.20–0.35	0.35–0.75	0.35–0.65	0.15–0.25
8660-H	0.55–0.65	0.70–1.05	0.20–0.35	0.35–0.75	0.35–0.65	0.15–0.25
8720-H	0.17–0.23	0.60–0.95	0.20–0.35	0.35–0.75	0.35–0.65	0.20–0.30
8740-H	0.37–0.44	0.70–1.05	0.20–0.35	0.35–0.75	0.35–0.65	0.20–0.30
8742-H	0.39–0.46	0.70–1.05	0.20–0.35	0.35–0.75	0.35–0.65	0.20–0.30
8750-H	0.47–0.54	0.70–1.05	0.20–0.35	0.35–0.75	0.35–0.65	0.20–0.30
9260-H	0.55–0.65	0.65–1.10	1.70–2.20	.....	.....	.....
9261-H	0.55–0.65	0.65–1.10	1.70–2.20	.....	0.05–0.35	.....
9262-H	0.55–0.65	0.65–1.10	1.70–2.20	.....	0.20–0.50	.....
9310-H	0.07–0.13	0.40–0.70	0.20–0.35	2.95–3.55	1.00–1.45	0.08–0.15
94B17-H	0.14–0.20	0.70–1.05	0.20–0.35	0.25–0.65	0.25–0.55	0.08–0.15
9840-H	0.37–0.44	0.60–0.95	0.20–0.35	0.80–1.20	0.65–0.95	0.20–0.30
9850-H	0.47–0.54	0.60–0.95	0.20–0.35	0.80–1.20	0.65–0.95	0.20–0.30

Source—American Iron & Steel Institute, 1955
*Sulphur content 0.040–0.060 per cent

NOTES

1. TS denotes tentative standard steels
2. Boron steels indicated by B can be expected to have 0.0005% min boron content
3. Notes 4, 6, 7 and 8 on Alloy Steels apply to H-Steels
4. Chemical composition ranges of steels ordered to end-quench hardenability are somewhat wider than the ranges applicable to the same grades when specified only to chemical composition. Wider ranges are necessary to adjust individual plant melting characteristics which might otherwise influence the levels and widths of the bands
5. X denotes grade modification

TITANIUM

Material	Producer	Composition (% max)	Forms*	Tensile Strength psi	Yield Strength psi	% Elong. in 2 in.
A-40	Rem-Cru Titanium Inc.	99+ Ti	S, B, W, T	50,000	40,000	22
RS-40	Republic Steel Corp.	C.P.; 0.20 C	S, B, F	50,000	40,000	22
Ti-55A	Titanium Metals Corp.	99+ Ti; 0.12 Fe; 0.05 N_2; 0.10 C	S, B, E, W, T	55,000	45,000	20
Ti-65A	Titanium Metals Corp.	99+ Ti; 0.12 Fe; 0.05 N_2; 0.10 C	S, B, E, W, T	65,000	55,000	20
RS-55	Republic Steel Corp.	C.P.; 0.20 C	S, B, F	65,000	55,000	20
A-55	Rem-Cru Titanium Inc.	99+ Ti; 0.20 C	S, B, W, T	65,000	55,000	20
Ti-75A	Titanium Metals Corp.	99+ Ti; 0.20 Fe; 0.08 N_2; 0.10 C	S, B, E, W, T	80,000	70,000	15
RS-70	Republic Steel Corp.	C.P.; 0.20 C	S, B, F	80,000	70,000	18
A-70	Rem-Cru Titanium Inc.	99+ Ti; 0.20 C	S, B, W, T	80,000	70,000	15
MST III	Mallory-Sharon Titanium Corp.	99+ Ti; 0.10 C	S, B, W, F	85,000	75,000	22
A-110AT	Rem-Cru Titanium Inc.	92 Ti; 5 Al; 2.50 Sn	S, B, W	115,000	110,000	10
RS-110A	Republic Steel Corp.	7 Mn; 0.20 C	S	120,000	110,000	10
RS-110BX	Republic Steel Corp.	3 Mn; 1.50 Al; 0.20 C	S, B, F	120,000	110,000	10
C-110M	Rem-Cru Titanium Inc.	91+ Ti; 5 Mn	S	120,000	110,000	10
Ti-140A	Titanium Metals Corp.	93+ Ti; 2 Fe; 2 Cr; 2 Mo; 0.08 N_2; 0.10 C	S, B, E, W	130,000	115,000	15
C-120AV	Rem-Cru Titanium Inc.	89+ Ti; 6 Al; 4 V	S, B, W	130,000	120,000	10
Ti-6A1-4V	Titanium Metals Corp.	89+ Ti; 6 Al; 4 V; 0.25 Fe; 0.05 N_2	S, B, E, W	130,000	120,000	10
MST 6 Al 4 V	Mallory-Sharon Titanium Corp.	5.50 to 6.50 Al; 3.50 to 4.50 V; 0.20 C	S, B, W, T, F, E	130,000	120,000	10
MST 8 Mn	Mallory-Sharon Titanium Corp.	92 Ti; 7 to 9 Mn; 0.20 C	S	135,000	120,000	12
C-130AM	Rem-Cru Titanium Inc.	91+ Ti; 4 Mn	S, B, W	140,000	130,000	10
RS-130	Republic Steel Corp.	4 Mn; 4 Al; 0.20 C	B, F	140,000	130,000	10
MST 4 Mn 4 Al	Mallory-Sharon Titanium Corp.	3.50 to 4.50 Mn; 3.50 to 4.50 Al; 0.20 C	B, W, T, F, E	140,000	130,000	12
RS-140X	Republic Steel Corp.	1.25 Fe; 2.75 Cr; 5 Al; 0.20 C	B, F	150,000	140,000	10
MST 3 Al 5 Cr	Mallory-Sharon Titanium Corp.	2.50 to 3.50 Al; 4.50 to 5.50 Cr; 0.20 C	B, E, F	150,000	140,000	12
Ti-155A	Titanium Metals Corp.	88+ Ti; 1.30 Fe; 1.40 Cr; 1.40 Mo; 5 Al; 0.05 N_2; 0.10 C	B, E, W	150,000	140,000	12

*S—Rolled flat products—sheet, strip, plate
B—Bar and billet
E—Extrusions
W—Wire
T—Tube
F—Forgings

STAINLESS and Heat-Resistant Steels

AISI No.	C	Mn Max	Si Max	Cr	Ni	P Max	S Max	Properties and Applications
201	0.15	5.5–7.5	1.00	16–18	3.5–5.5	0.060	0.030	Low-nickel alternate for 301
	Other: N 0.25 max							
202	0.15 max	7.5–10.0	1.00	17–19	4–6	0.060	0.030	Low-nickel alternate for 302
	Other: N 0.25 max							
301	0.15 max	2.00	1.00	16–18	6–8	0.045	0.030	Rapid work hardening. Railroad cars, trailer bodies, aircraft structurals
302	0.15 max	2.00	1.00	17–19	8–10	0.045	0.030	General-purpose chromium-nickel type. Trim, food handling equipment, jewelry, aircraft cowling, antennas, springs, architectural, cookware (302 clad)
302B	0.15 max	2.00	2–3	17–19	8–10	0.045	0.030	Higher scaling resistance at elevated temperatures than 302. Furnace parts, still liners
303	0.15 max	2.00	1.00	17–19	8–10	0.200	0.15 min	Free machining; lower galling tendency than 302. Screw machine products, shafts, valves
303Se	0.15 max	2.00	1.00	17–19	8–10	0.200	0.06	Somewhat better transverse mechanical properties and slightly lower machinability than 303
	Other: Se 0.15 min							
304	0.08 max	2.00	1.00	18–20	8–12	0.045	0.030	General-purpose alloy for welding. Chemical and food processing equipment, recording wire
304L	0.03 max	2.00	1.00	18–20	8–12	0.045	0.030	Weldments for corrosive conditions where intergranular carbide precipitation must be avoided
305	0.12 max	2.00	1.00	17–19	10–13	0.045	0.030	Low work-hardening rate. Maximum plasticity for forming, spinning and cold heading
308	0.08 max	2.00	1.00	19–21	10–12	0.045	0.030	Welding rod and electrodes
309	0.20 max	2.00	1.00	22–24	12–15	0.045	0.030	High scale resistance and good strength at high temperatures. Aircraft heaters, heat treating equipment, annealing covers, furnace parts
309S	0.08 max	2.00	1.00	22–24	12–15	0.045	0.030	Weldments with high scale resistance
310	0.25 max	2.00	1.50	24–26	19–22	0.045	0.030	Like 309 but even higher heat resistance. Excellent for general use. Hydrogenation tubes, heat exchangers, furnace parts, combustion chambers
310S	0.08 max	2.00	1.50	24–26	19–22	0.045	0.030	Like 309S but has even higher heat resistance
314	0.25 max	2.00	1.5–3	23–26	19–22	0.045	0.030	Highest heat resistance. Uses similar to 310. Resistant to carburizing
316	0.08 max	2.00	1.00	16–18	10–14	0.045	0.030	Higher resistance to corrosives affecting other stainless steels. High creep resistance. High temperature parts, chemical and pulp handling equipment, photographic and food equipment
	Other: Mo 2–3							
316L	0.03 max	2.00	1.00	16–18	10–14	0.045	0.030	Version of 316 for weldments where intergranular carbide precipitation must be avoided. Permits stress relief at 1550–1650° F
	Other: Mo 1.75–2.3							
317	0.08 max	2.00	1.00	18–20	11–15	0.045	0.030	Higher in corrosion resistance than 316
	Other: Mo 3–4							
321	0.08 max	2.00	1.00	17–19	9–12	0.045	0.030	For weldments subject to severely corrosive conditions and service in 800–1650° F range. Aircraft exhaust manifolds, boiler shells, expansion joints, process equipment
	Other: Ti 5xC min							
347	0.08 max	2.00	1.00	17–19	9–13	0.045	0.030	For uses similar to 321. More widely used for welded process equipment
	Other: Cb 10xC min							
348	0.08 max	2.00	1.00	17–19	9–13	0.045	0.030	Equivalent to 347. For atomic energy applications due to low retentivity
	Other: Cb 10xC min, Ta 0.1 max							
403	0.15 max	1.00	0.50	11.5–13	....	0.040	0.030	Steam turbine blades, jet engine compressor blades, highly stressed parts
405	0.08 max	1.00	1.00	11.5–14.5	....	0.040	0.030	Nonhardenable. For welded assemblies where air-hardening of type 410 or 403 is objectionable
	Other: Al 0.10–0.30							
410	0.15 max	1.00	1.00	11.5–13.5	....	0.040	0.030	General-purpose corrosion and heat resistance. Hardenable by heat treatment. Coal screens, low priced cutlery, machine parts, valve trim
414	0.15 max	1.00	1.00	11.5–13.5	1.25–2.5	0.040	0.030	High-strength version of 410. Rules and straight edges, mild springs, scraper knives
416	0.15 max	1.25	1.00	12–14	....	0.060	0.15 min	Free machining. Bolts, nuts and screws, carburetor parts, fishing reels, golf club heads, instrument parts, screw machine parts, valve trim
	Other: Mo 0.60 max, Zr 0.60 max							
416Se	0.15 max	1.25	1.00	12–14	....	0.060	0.060	Slightly higher transverse properties and slightly lower machinability than 416
	Other: Se 0.15 min							
420	Over 0.15	1.00	1.00	12–14	....	0.040	0.030	High hardness from heat treatment. General purpose cutlery grade. Surgical instruments
430	0.12 max	1.00	1.00	14–18	....	0.040	0.030	General-purpose nonhardenable chromium type. Decorative trim, nitric acid tanks, annealing baskets, auto trim, sinks
430F	0.12 max	1.25	1.00	14–18	....	0.060	0.15 min	Free-machining bars. Screw machine parts, screws and other fasteners
	Other: Mo 0.60 max, Zr 0.60 max							
430FSe	0.12 max	1.25	1.00	14–18	....	0.060	0.060	Free machining, retaining forgeability. Fine finish quality. Similar to 430F
	Other: Se 0.15 min							
431	0.20 max	1.00	1.00	15–17	1.25–2.5	0.040	0.030	Special-purpose hardenable type. Aircraft fittings, bolts, paper machinery, windshield wiper arms, beater bars, springs
440A	0.6–0.75	1.00	1.00	16–18	....	0.040	0.030	High strength and corrosion resistance. Hardenable by heat treatment. Toughest high chrome cutlery grade, bearings, seaming rolls, surgical tools
	Other: Mo 0.75 max							
440B	0.75–0.95	1.00	1.00	16–18	....	0.040	0.030	Cutlery grade. Uses similar to 440A
	Other: Mo 0.75 max							
440C	0.95–1.20	1.00	1.00	16–18	....	0.040	0.030	Ball bearing grade. Also bushings, valve parts, cutlery
	Other: Mo 0.75 max							
446	0.20 max	1.50	1.00	23–27	....	0.040	0.030	Resistance to high-temperature scaling, hot sulphur-bearing gases and oxidizing acids
	Other: N 0.25 max							
501	Over 0.1	1.00	1.00	4–6	....	0.040	0.030	Moderate resistance to scaling, but limited corrosion resistance. Oil industry equipment—stills, heat exchangers, hot lines
	Other: Mo 0.40–0.65							
502	0.1 max	1.00	1.00	4–6	....	0.040	0.030	Similar uses to 501
	Other: Mo 0.40–0.65							

Metal Selector

Here is the practical information needed to help you select the right metal for the job

COPPER Wrought Alloys

Name	Nominal Composition[1]	Forms Used[2]	Machinability[3]	Applications
COPPERS:				
Electrolytic tough pitch	Cu 99.92; O 0.04	R,D,S,W,T	20	Radiators, electrical wire, flashing
Deoxidized	Cu 99.94; P 0.02	R,D,S,T	20	Plumbing, refrigeration, oil lines
Oxygen-free copper	Cu 99.92 min	R,D,S,W,T	20	Electronics, bus bar, radar
BRASSES—Nonleaded:				
Gilding, 95%	Cu 95; Zn 5	R,D,W	20	Medals, bullet jackets, jewelry
Commercial bronze, 90%	Cu 90; Zn 10	R,D,W,T	20	Door knobs, weather stripping, screen
Jewelry bronze, 87.5%	Cu 87.5; Zn 12.5	R,W	30	Slide fasteners, bead chain, plaques
Red brass, 85%	Cu 85; Zn 15	R,D,W,T	30	Fire extinguishers, compacts, plumbing
Low brass, 80%	Cu 80; Zn 20	R,D,W	30	Bellows, musical instruments, dials
Cartridge brass, 70%	Cu 70; Zn 30	R,D,W,T	30	Cartridge cases, springs, eyelets
Yellow brass	Cu 65; Zn 35	R,D,W	30	Lamp fixtures, hinges, screws
Muntz metal	Cu 60; Zn 40	R,D,W,T	40	Condenser plates, brazing rod, trim
LEADED BRASSES:				
Leaded commercial bronze	Cu 89; Pb 1.75; Zn 9.25	D,S	80	Electrical connectors, bolts, hardware
Low-leaded brass (tube)	Cu 66; Pb 0.5; Zn 33.5	T	60	Pump lines, primers, J-bends
Low-leaded brass	Cu 65; Pb 0.5; Zn 34.5	R	60	Sink strainers, butts, watch backs
Medium-leaded brass	Cu 65; Pb 1; Zn 34	R,D,S,W	70	Dials, clock plates, gears, nuts
High-leaded brass (tube)	Cu 66; Pb 1.6; Zn 32.4	T	80	Collars, large hex nuts, bushings
High-leaded brass	Cu 65; Pb 2.0; Zn 33.0	R,D	90	Nuts, gears, clock wheels
Extra-high-leaded brass	Cu 63; Pb 2.5; Zn 34.5	R	100	Nuts, gears, clock wheels
Free-cutting brass	Cu 61.5; Pb 3; Zn 35.5	D,S	100	Nuts, adaptors, gears, pinions
Leaded Muntz metal	Cu 60; Pb 0.6; Zn 39.4	R	60	Condenser tube plates, screening
Free-cutting Muntz metal (tube)	Cu 60; Pb 1; Zn 39	T	70	Collars, large hex nuts, bushings
Forging brass	Cu 60; Pb 2; Zn 38	R,D,S	80	Valve parts, door latches, refrigerator fittings
Architectural bronze	Cu 57; Pb 3; Zn 40	D,S	90	Extruded building trim and hardware
TIN & ALUMINUM BRASSES:				
Inhibited Admiralty	Cu 71; Zn 28; Sn 1	R,W,T	30	Condenser, heat exchanger tubes and plates
Naval brass	Cu 60; Zn 39.25; Sn 0.75	R,D,S,W,T	30	Valve stems, marine uses, propeller shafts
Leaded naval brass	Cu 60; Pb 1.75; Zn 37.5; Sn 0.75	D,S	70	Bolts, nuts, valve parts
Manganese bronze	Cu 58.5; Fe 1; Zn 39.2; Sn 1; Mn 0.3	R,D,S,W	30	Welding rods, pump rods, valve bodies
Aluminum brass	Cu 76; Zn 22; Al 2	T	30	Condenser, heat exchanger tubes
Aluminum bronze, 5%	Cu 95; Al 5	T	20	Condenser, heat exchanger tubes
PHOSPHOR BRONZES (Tin Bronzes):				
Phosphor bronze, 5%	Cu 95; Sn 5	R,D,W,T	20	Bellows, welding rod, electrical switch parts
Phosphor bronze, 8%	Cu 92; Sn 8	R,D,W	20	Electrical switch parts, bushings, springs
Phosphor bronze, 10%	Cu 90; Sn 10	R,D,W	20	Bridge plates, beater bars, springs
Phosphor bronze, 1.25%	Cu 98.75; Sn 1.25; P trace	R	20	Electrical contacts, flexible hose, pole-line hardware
Free-cutting Phosphor Bronze	Cu 88; Pb 4; Zn 4; Sn 4	R,D	80	Bearings, bushings, valve parts
CUPRO-NICKEL & NICKEL SILVERS:				
Cupro-nickel, 30%	Cu 70; Ni 30	R,D,T	20	Condenser and salt water tubing
Cupro-nickel, 10%	Cu 88.7; Fe 1.3; Ni 10	R,T	20	Condenser and salt water tubing
Nickel silver, 65-18	Cu 65; Zn 17; Ni 18	R,D,W	20	Flatware, zippers, hollow ware
Nickel silver, 55-18	Cu 55; Zn 27; Ni 18	R,D,W	30	Electrical springs, diaphragms, electronics
Nickel silver, 65-15	Cu 65; Zn 20; Ni 15	R	20	Camera parts, costume jewelry, name plates
Nickel silver, 65-12	Cu 65; Zn 23; Ni 12	R,W	20	Etching stock, slide fasteners, hollow ware
Nickel silver, 65-10	Cu 65; Zn 25; Ni 10	R,W	20	Screws, flatware, platers' bars
SILICON BRONZES (Copper-Silicon Alloys):				
High-silicon bronze	Cu 96; Si 3	R,D,S,W,T	30	Screws, bolts, pole-line hardware
Low-silicon bronze	Cu 97.7; Si 1.5	R,D,S,W,T	30	Bolts, screws, nuts, rivets

1. Only major elements listed

2. Abbreviations:
R—rolled flat products
D—rod and drawn flat products
S—shapes
W—wire (except flat)
T—tube

3. Basis: Free-cutting brass = 100

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FERROUS CASTINGS

GRAY IRON

ASTM Spec. No.	ASTM Class	Tensile Min psi	Heat Treatment *	Min Section in.	Properties and Typical Applications
A-190			2	1/8	Light weight and thin section castings requiring good appearance, where strength is not prime requisite. Specific qualities usually established by sample
A-48	20	20,000	2	1/8	Same as A-190 with minimum tensile requirement. Excellent machinability as annealed
	25	25,000			
	30	30,000	1	1/4	Most commonly used grade for general machinery, valves, light compressor bodies, municipal castings, waterworks equipment. Good mechanical properties with high machinability
	35	35,000			
	40	40,000	1	1/4	Machine tools, medium gear blanks, heavy compressors and motor blocks
	50	50,000	1	3/8	Large castings for heavy service, dies, hydraulic cylinders, machine tools, permanent molds, large gears, press frames
	60	60,000	1	1/2	Unusual strength or wear resistance for large castings with severe service requirements
A-278	40	40,000	3	1/2	Pressure containing parts, such as heat exchangers, for use up to 650° F
	50	50,000	3	3/4	
		60,000	3	1	
A-319	I		2	1/4	I: Superior resistance to thermal shock. II: Average resistance to thermal shock; moderate tensile strength. III: High creep and rupture strength. For castings exposed to high temperatures—grate bars, stokers, oil still parts, metal and glass molds, melting pots
	II		2	1/2	
	III		2	1	

NODULAR (S. G. or Ductile) IRON

339	80-60-03	80,000	1	1/8	High yield strength and wear resistance, such as gears, dies, drums and heavy duty machinery
	60-45-10	60,000	2	1/8	For maximum toughness and excellent machinability
	120-90-02	120,000	4	1/8	Heat treated grades for applications subject to high mechanical stress
	100-70-03	100,000	4	1/8	

Source: Gray Iron Founders' Society Inc.
*1. Hardenable by conventional heat treatment as well as by flame or induction. 2. Hardening not recommended. 3. Must be stress relief annealed. 4. All heat treated to raise yield and tensile strength

MALLEABLE IRON

ASTM Spec. No.	ASTM No.	Tensile Min psi	Yield Min psi	Elong. in 2 in. min %	Properties and Typical Applications
		STANDARD			
A-47	32510	50,000	32,500	10	Tough, impact and fatigue resistant, easily machined. Castable in 1/4-in. minimum sections. Automobile differential cases, steering gear housings, hubs, brackets, railroad car construction and track parts, agricultural implement parts
	35018	53,000	35,000	18	
		PEARLITIC			
A-220T	45010	65,000	45,000	10	High strength, hardness, resistance to abrasion, good machinability. Automotive valve rocker arms, transmission parts, agricultural implement gears, sprockets, crankshafts, weapon parts. Hardenable to 50-60 Rockwell C
	45007	68,000	45,000	7	
	48004	70,000	48,000	4	
	50007	75,000	50,000	7	
	53004	80,000	53,000	4	
	60003	80,000	60,000	3	
	80002	100,000	80,000	2	

Source: Malleable Founders' Society

CAST STEEL—Carbon Structural Grades

Tensile Min psi	Yield Min psi	Specifications ASTM or SAE	C range	Mn range	Properties and Typical Applications
60,000 Min Elong 24%	30,000	A 27-52T U 60-30 60-30	0.10-0.20	0.50-1.00	Low electrical resistivity, excellent weldability. Can be carburized and case hardened. Electrical equipment, gears, drums, railroad and furnace equipment
65,000 Min Elong 24%	35,000	A 27-52T 65-30, 65-35 SAE 0030	0.20-0.30	0.60-1.00	Excellent weldability, medium strength, good durability and machinability. Railroad, power shovel, rolling mill equipment, presses, gears, sprockets, machine frames, castings
70,000 Min Elong 24%	38,000	A 27-52T 70-36 A 95-44 70-36 A 216-53T WCB	0.25-0.35	0.60-1.00	Sprockets, machine frames. Miscellaneous medium strength castings
80,000 Min Elong 17%	40,000	SAE 080	0.50 max	1.00 max	High strength, toughness, good fatigue, wear resistance, high rigidity. Gears, rolls, blanking and forming dies, pinions, sprockets, machine tools, impellers, liners
85,000 Min Elong 16%	45,000	SAE 0050	over 0.50	1.00 max	Castings requiring rigidity and hardness

CAST STEEL—Low Alloy Engineering Grades

Tensile Min psi	Yield Min psi	Specifications ASTM or SAE	Normalized & Tempered	Water Quenched & Tempered	Properties and Typical Applications
80,000 Min Elong 22%	50,000	A 148-50T 80-40 80-50 SAE 090	1330 2317 4032 6120 Mn Mo* TS8130		Excellent weldability, medium strength with high toughness and good machinability; shock and abrasion resistance. Pneumatic tools, railroad equipment, pressure parts, automotive parts, track wheels, tractor treads, gears, sprockets
90,000 Min Elong 20%	60,000	A 148-50T 90-60 SAE 090	1335 3130 4137 4630 6130 Mn Mo* Mn V**	1330 4028 5135	Offers a variety of strengths and hardenabilities, depending on alloy content *Normalized & Tempered:* Oil well tools, sheaves, sprockets, locomotive parts, gears, cams, earth-moving equipment, highly stressed castings
100,000 Min Elong 17%	65,000		3135 4140 4330 4635 6130 Mn Mo* TS8630 8630 4032 TS8130	4032 TS8130 Mn Mo*	*Quenched & Tempered:* Hardened castings, gears, cams, rollers, abrasion resistant castings, bucket teeth, small crusher jaws, conveyor chain links, dredge pumps, impellers, valve liners, oil field tongs
110,000 Min Elong 17%	85,000	A 148-50T 105-85 SAE 0105	4140 4335 9530	3130 4130 4030 4630 Mn Mo*	High resistance to impact, excellent strength and toughness
120,000 Min Elong 14%	95,000	A 148-50T 120-95 SAE 0120	4340	3135 6130 Mn Mo* TS8630 8630 9530 4340	*Normalized & Tempered:* Excellent air hardening properties. Abrasion resistant applications, dredge pumps, gears, dies, rolling mill equipment. Molybdenum-bearing castings for shock valves, flanges, turbine casings, hydroelectric equipment *Quenched & Tempered:* Good low temperature impact toughness, excellent abrasion resistance, deep hardening
150,000 Min. Elong 9%	125,000	A 148-50T 150-125 SAE 0150		4330 9530	Deep hardening, high strength, and high wear resistance
175,000 200,000	Custom steels for special engineered products				

Source: Steel Founders' Society of America

*Mn Mo=C 0.25-0.35, Mn 1.25-1.75, Mo 0.15-0.25
**Mn V=C 0.25-0.35, Mn 1.25-1.75, V 0.10-0.15

ALUMINUM Casting Alloys

Alloy	Composition Limits % max or range; Al remainder	Properties and Uses by Casting Type
13 ASTM S12A-B SAE 305	Cu 0.6; Fe 0.8; Si 11.0-13.0; Mn 0.35; Mg 0.10; Zn 0.35; Ni 0.50; Sn 0.15; others 0.25	Excellent castability with good corrosion resistance. Good mechanical properties. General-purpose alloy for large intricate parts with thin sections. Die: Typewriter frames, outboard motor pistons, dental equipment and instrument cases
Apex Z-33	Cu 2.5-3.5; Si 4.5-5.5; Mg 0.10; Zn 2.5-3.5; Fe 1.0; Mn 0.50; others 0.50	Good machinability, fair castability. Takes high polish. Similar to Z-50. Sand: Household appliances, automotive and miscellaneous machined parts
Apex Z-39	Cu 3.5-4.5; Si 8.5-9.5; Mg 0.1; Zn 1.5-2.5; Fe 1.2; Mn 0.5; Ni 0.5; others 0.4 each	Good castability and excellent machinability. Die: Automatic transmission impellers and housings, toys, brackets and other castings where machining is required
43 ASTM S5A SAE 35, 304	Cu 0.15; Fe 0.6; Si 4.5-6.0; Mn 0.35; Mg 0.05; Zn 0.35; Ti 0.25; others 0.05 each	Excellent castability and pressure tightness, good weldability and good corrosion resistance. Permanent Mold: Carburetor bodies, refrigerator shelf brackets and fittings, cooking utensils and general-purpose thin-section castings. Sand: Architectural and ornamental parts, pipe fittings, cooking utensils, food handling equipment and marine fittings. Die: General-purpose castings
Apex Z-50	Cu 4.0-5.0; Si 2.5-3.5; Mg 0.07; Zn 1.5-2.5; Fe 1.0; Mg 0.6; Ni 0.3	Good machinability, fair castability. Takes high polish. Sand: Household appliances, automotive and miscellaneous machined parts
108 ASTM C8-43A	Cu 3.5-4.5; Fe 1.0; Si 2.5-3.5; Mn 0.50; Mg 0.05; Zn 1.0; Ti 0.25; Ni 0.35; others 0.50	General-purpose alloy with fair castability. Sand: Manifolds, valve bodies and similar castings
A-108 ASTM SC64A	Cu 4.0-5.0; Fe 0.8; Si 5.0-6.0; Mn 0.50; Mg 0.10; Zn 1.0; Ti 0.25; others 0.50	Good castability and pressure tightness with good weldability. Permanent Mold: Ornamental grilles, reflectors and general-purpose castings. Used where leak tightness and moderate strength are needed
112 ASTM C872A SAE 33	Cu 6.0-8.0; Fe 1.2; Si 1.0-4.0; Mn 0.6; Mg 0.10; Zn 2.5; Ti 0.25; Ni 0.35; others 0.50	Fair castability and good machinability. Early general-purpose alloy. 212 is similar but has better castability. Permanent Mold: Vacuum cleaner housings; general-purpose castings. Sand: Transmission housings, cover plates, manifolds and miscellaneous machined castings
A132 ASTM SN122A SAE 321	Cu 0.50-1.5; Fe 1.0; Si 11.0-13.0; Mn 0.35; Mg 0.9-1.3; Zn 0.35; Ti 0.25; Ni 2.0-3.0	Good high-temperature properties at 500-600° F. Low coefficient of thermal expansion. Weldability good. Permanent Mold: Pulleys and sheaves, automotive and diesel pistons
D132 SAE 332	Cu 2.0-4.0; Fe 1.0; Si 8.5-10.5; Mn 0.5; Mg 0.5-1.5; Zn 0.5; Ni 1.5; others 0.3	Similar to A132 but with better castability and machinability
138 ASTM CS104A	Cu 9.0-11.0; Fe 1.2; Si 3.5-4.5; Mn 0.6; Mg 0.20-0.35; Zn 1.5; Ti 0.25; Ni 1.0; others 0.50	High as-cast hardness. Good castability and good machinability. Permanent Mold: Sole plates for electric hand irons
142 (Y-alloy) ASTM CN42A SAE 39	Cu 3.5-4.5; Fe 0.8; Si 0.7; Mn 0.35; Mg 1.3-1.8; Zn 0.35; Cr 0.25; Ti 0.25; Ni 1.7-2.3; others 0.15	Good strength at elevated temperatures. Permanent Mold: Aircraft generator housings, motorcycle, diesel and aircraft pistons, air cooled cylinder heads. Sand: Diesel engine pistons and air cooled cylinder heads

ALUMINUM (Continued)

Alloy	Composition Limits % max or range; Al remainder	Properties and Uses by Casting Type
Apex Red X 8 ASTM SC82A SAE 327	Cu 1.0-2.0; Si 7.0-8.5; Mg 0.2-0.6; Zn 1.0; Cr 0.3; Fe 0.8; Mn 0.2-0.6; others 0.2 each	Castability and mechanical properties good. Rugged, tough alloy for extreme application. Sand: Cylinder blocks, crankcases, supercharger housings and general automotive use
Apex Red X 11	Cu 1.0-2.0; Si 10.5-11.8; Mg 0.4-1.0; Zn 0.6; Fe 0.9; Mn 0.5-0.9; others 0.2 each	Good castability with low coefficient of expansion. Permanent Mold: Automotive pistons and similar applications
152 Apex 66 ASTM CS66A	Cu 5.5-7.5; Fe 1.2; Si 5.0-6.0; Mn 0.8; Mg 0.25-0.40; Zn 0.8; Ti 0.25; others 0.8	Good elevated temperature strength and good machinability. Permanent Mold: Automotive pistons
195 ASTM C4A SAE 38	Cu 4.0-5.0; Fe 0.8; Si 0.50-1.5; Mn 0.35; Mg 0.03; Zn 0.35; Ti 0.25; others 0.15	Castability fair with good machining properties. Good balance of mechanical properties for parts needing strength and ruggedness. Sand: Flywheel and rear axle housings, bus and aircraft wheels, spring hangers, fittings, crankcases
B195 ASTM CS42A SAE 380	Cu 4.0-5.0; Fe 1.0; Si 2.0-3.0; Mn 0.35; Mg 0.05; Zn 0.50; Ti 0.25; others 0.35	Alloy 195 modified to give better castability. Weldability and machinability good. Permanent Mold: Aircraft fittings, wheels, gear housings and gun control parts; railroad car seat frames; compressor connection rods
214 ASTM G4A SAE 320	Cu 0.15; Fe 0.45; Si 0.35; Mn 0.35; Mg 3.6-4.5; Zn 0.15; Ti 0.25; others 0.15	Good balance of mechanical properties. Excellent corrosion and tarnish resistance. Good alloy for anodizing. Sand: Dairy and food handling equipment, cooking utensils, fittings for chemical and sewage use, hardware and ornamental housings
A214 ASTM GZ42A	Cu 0.35; Fe 0.50; Si 0.35; Mn 0.8; Mg 3.6-4.5; Zn 1.4-2.2; Ti 0.25; others 0.15	Alloy 214 modified for permanent mold castings. Good corrosion and tarnish resistance. Permanent Mold: Cooking utensils
B214 ASTM GS42A	Cu 0.35; Fe 0.50; Si 1.4-2.2; Mn 0.8; Mg 3.6-4.5; Zn 0.35; Cr 0.25; Ti 0.25; others 0.15	Better castability than 214 but reduced mechanical properties. Excellent corrosion resistance. Sand and Permanent Mold: Cooking utensils. Pipe fittings for marine and general use
218 ASTM G8A	Cu 0.25; Fe 0.8; Si 0.35; Mn 0.35; Mg 7.6-8.5; Zn 0.15; Ni 0.15; Sn 0.15; others 0.25	Good resistance to corrosion and tarnish. Excellent strength and ductility. Good for anodizing. Die: Parts requiring high strength, ductility and corrosion resistance, such as aircraft brake shoes and fittings, conveyor units, hardware. Not best for intricate parts
220 ASTM G10A SAE 324	Cu 0.25; Fe 0.20; Si 0.25; Mn 0.15; Mg 9.6-10.6; Zn 0.15; Ti 0.25; others 0.15	Requires special foundry practice. Highest strength and elongation of any sand-casting alloy where heat treated. Good machinability and corrosion resistance. Sand: Parts requiring strength and shock resistance: Aircraft fittings, levers, brackets, railroad passenger car frames. Not for use above 250° F
319 ASTM SC64C SAE 326	Cu 3.0-4.5; Fe 1.0; Si 5.5-7.0; Mn 0.8; Mg 0.50; Zn 1.0; Ti 0.25; Ni 0.50; others 0.50	Excellent castability with good mechanical properties. Sand: Piano plates and frames, gasoline and oil tanks, engine crankcases, oil pans, rear-axle housings requiring leak tightness, general purpose uses
A319 Apex Alloast 70 ASTM SC64B SAE 326	Cu 3.3-4.3; Fe 0.8; Si 5.5-7.0; Mn 0.50; Mg 0.10; Zn 1.0; Ti 0.25; Ni 0.35; others 0.50	Excellent castability, good mechanical properties. Pressure tightness exceptional. Sand: Engine crankcases, oil pans, automatic transmission housings. Permanent Mold: Typewriter frames, engine parts, water cooled cylinder heads
355 ASTM SC51A SAE 322	Cu 1.0-1.5; Fe 0.6; Si 4.5-5.5; Mn 0.50; Mg 0.45-0.60; Zn 0.35; Cr 0.25; Ti 0.25; others 0.15	Castability and weldability good. Pressure tightness good. Parts usually heat treated. Permanent Mold: Aircraft supercharger covers, impellers, fittings and timing gears. Meter parts and fuel pump bodies. Sand: Air compressor pistons, printing press bed plates, crankcases, water jackets, gear housings, electric motor fans and blowers
356 ASTM SG70A SAE 323	Cu 0.25; Fe 0.50; Si 6.5-7.5; Mn 0.35; Mg 0.25-0.40; Zn 0.35; Ti 0.25; others 0.15	Castability and weldability good. Good pressure tightness and resistance to corrosion. Parts usually heat treated. Permanent Mold: Machine tool parts, hand wheels, aircraft pump parts. Sand: Automotive transmission cases, flywheel housings, oil pans, rear axle housings, brackets, fittings and pump bodies
Apex Ternalloy 5 ASTM ZG52A SAE 311	Cu 0.2; Si 0.2; Mg 1.4-1.8; Zn 2.7-3.3; Cr 0.2-0.4; Fe 0.6; Mn 0.4-0.6; Ni 0.2; Ti 0.25; others 0.05 each	High strength and good elongation without heat treatment. Exceptional dimensional stability. Good brazing alloy. Sand: Pipe fittings, wrenches, farm machinery, machine tool equipment, high pressure valves and other applications requiring high strength. Permanent Mold: Street lighting equipment, heavy-duty brackets, tooling equipment, precision gages and castings for electronic use
Apex Ternalloy 7 ASTM ZG42A SAE 312	Cu 0.20; Si 0.20; Mg 1.8-2.4; Zn 4.0-4.5; Fe 0.6; Mn 0.40-0.60; Cr 0.20-0.40; Ti 0.25; others 0.05 each	Same as Ternalloy 5 but for parts needing less elongation and higher yield strength. Sand and Permanent Mold: Can be heat treated to very high strength
360 ASTM SG100A-B	Cu 0.6; Fe 0.8; Si 9.0-10.0; Mn 0.35; Mg 0.45-0.6; Zn 0.35; Ni 0.50; Sn 0.15; others 0.25	Excellent castability. Mechanical properties and corrosion resistance good. Die: Cover plates, instrument cases, general purpose castings
380 ASTM SC84A-B	Cu 3.0-4.0; Fe 1.0; Si 7.5-9.5; Mn 0.50; Mg 0.10; Zn 0.9; Ni 0.50; Sn 0.35; others 0.50	Castability and mechanical properties good. Good machinability. Die: General-purpose parts
382	Cu 0.1; Fe 0.4; Si 3.0-4.0; Mn 0.1; Mg 1.7-2.5; Cr 0.2; Ti 0.2; others 0.15	Castability and pressure tightness good with excellent machinability. Permanent Mold: Cooking utensils, pipe fittings and architectural parts
384 ASTM SC114A	Cu 3.0-4.5; Fe 1.0; Si 11.5-13.0; Mn 0.6; Mg 0.1; Zn 1.2	Excellent for thin walls. Die: Wringer frames, toys, automatic transmissions, general-purpose thin wall castings
Apex 417	Cu 0.2; Si 0.2; Mg 6.5-7.5; Zn 0.3; Fe 0.4; Mn 0.3; Ti 0.2; others 0.05 each	High strength, exceptional ductility; good anodizing characteristics and machinability. Sand: C-clamps, brackets and machined parts requiring strength, machinability, corrosion resistance, polishing and anodizing. Permanent Mold: Impellers, disposal parts, camera and optical equipment needing high polish or anodized finish
A612 ASTM ZG61B SAE 313	Cu 0.35-0.65; Fe 0.45; Si 0.15; Mn 0.05; Mg 0.6-0.8; Zn 6.0-7.0; Ti 0.25; others 0.15	High strength and ductility without heat treatment. Good machinability. Sand: General purpose castings, particularly for brazing
C612 ASTM ZC60A SAE 314	Cu 0.35-0.65; Fe 1.3; Si 0.35; Mn 0.05; Mg 0.25-0.45; Zn 6.0-7.0; Ti 0.25; others 0.15	High strength and ductility without heat treatment. Good machinability. Permanent Mold: Torque converter impeller blades and furniture parts requiring brazing
Federated Tenzaloy ASTM ZC81A-B	Cu 0.35-0.65; Fe 1.3; Si 0.35; Mn 0.05; Mg 0.25-0.50; Zn 7.0-8.0; Cr 0.35; Ti 0.25; Ni 0.15; others 0.25	High strength without heat treatment. Ages at room temperature to give properties of heat treated castings. Permanent Mold: Machine tool frames, high-speed fan rotors. Sand: Housings for hoists and other heavy duty equipment. Street signs and brackets
40E ASTM ZG61A SAE 310	Cu 0.30; Fe 0.8; Si 0.25; Mn 0.30; Mg 0.50-0.65; Zn 5.2-6.0; Cr 0.40-0.60; Ti 0.10-0.25; others 0.25	Good mechanical properties without heat treatment. Good resistance to corrosion and shock. Sand: Aircraft and instrument parts subject to shock
750	Cu 0.7-1.3; Fe 0.7; Si 0.7; Mn 0.10; Ni 0.7-1.3; Ti 0.20; Sn 5.5-7.0; others 0.30	Good bearing qualities with good compressive strength. Permanent Mold and Sand: Bearings, bushings and parts needing bearing properties

ALUMINUM Wrought Alloys

Alloy Designation Al Assn.	Old Comi.	Chemical Composition % max or range, Al remainder	Commercial Forms*	Typical Applications
EC	EC	Al 99.45 min	S,W,B,E,T	Electrical conductors
1100	2S	Si & Fe 1.0; Cu 0.20; Mn 0.05; Zn 0.10; Al 99.00 min	S,W,B,E,T,F	Sheet metal work, spun hollow ware and decorative parts. Good formability
1130	R308	Si & Fe 0.7; Cu 0.20; Al 99.30 min	S	No. 1 reflector sheet
1160	None	Si & Fe 0.40; Cu 0.05; Al 99.60 min	S	Chemical equipment and tank cars for chemicals such as hydrogen peroxide
2011	11S	Si 0.40; Fe 0.7; Cu 5.0-6.0; Zn 0.30; Pb 0.20-0.60; Bi 0.20-0.60	W,B,E	Screw machine products
2014	14S R301	Si 0.50-1.2; Fe 1.0; Cu 3.9-5.0; Mn 0.40-1.2; Mg 0.20-0.80; Cr 0.10; Zn 0.25; Ti 0.15	S,W,B,E,T,F	Heavy-duty structures, aircraft structures and truck frames. High strength with good machinability
Alclad 2014		(same as above)	S	Used where corrosion resistance better than 2014 is needed
2017	17S	Si 0.80; Fe 1.0; Cu 3.5-4.5; Mn 0.40-1.0; Mg 0.20-0.80; Cr 0.10; Zn 0.25	W,B	Screw machine products. Higher strength than 2011
2018	18S	Si 0.90; Fe 1.0; Cu 3.5-4.5; Mn 0.20; Mg 0.45-0.90; Cr 0.10; Ni 1.7-2.3; Zn 0.25	F	Aircraft engine cylinder heads and pistons. High strength with good machinability
2024	24S	Si 0.50; Fe 0.50; Cu 3.8-4.9; Mn 0.30-0.90; Mg 1.2-1.8; Cr 0.10; Zn 0.25	S,W,B,E,T	Aircraft structures, truck wheels and screw machine products. High strength and hardness with good machinability
Alclad 2024		(same as above)	S	Same as 2024 with greater corrosion resistance
2025	25S	Si 0.50-1.2; Fe 1.0; Cu 3.9-5.0; Mn 0.40-1.2; Mg 0.05; Cr 0.10; Zn 0.25; Ti 0.15	F	Propeller blades and other high strength forgings
2117	A17S	Si 0.8; Fe 1.0; Cu 2.2-3.0; Mn 0.20; Mg 0.20-0.50; Cr 0.10; Zn 0.25	W	Cold heading wire and rivets
2218	B18S	Si 0.9; Fe 1.0; Cu 3.5-4.5; Mn 0.20; Mg 1.2-1.8; Cr 0.10; Ni 1.7-2.3; Zn 0.25	F	Aircraft engine cylinder heads and pistons, jet engine impellers and compressor rings
3003	3S	Si 0.60; Fe 0.70; Cu 0.20; Mn 1.0-1.5; Zn 0.10	S,W,B,E,T,F	Cooking utensils, chemical equipment, pressure vessels, tanks, piping, architectural applications and builders' hardware
Alclad 3003		(same as above)	S,T	Tea kettles, chemical equipment, heat exchange tubes, pressure vessels, storage tanks and flashing
3004	4S	Si 0.30; Fe 0.70; Cu 0.20; Mn 1.0-1.5; Mg 0.8-1.3; Zn 0.10	S	Special sheet metal work, shoe eyelets, pressure vessels and storage tanks
Alclad 3004		(same as above)	S	Industrial building sheet and flashing
4032	32S	Si 11.0-13.5; Fe 1.0; Cu 0.50-1.3; Mg 0.80-1.3; Cr 0.10; Ni 0.50-1.3; Zn 0.25	F	Pistons
4043	43S K145	Si 4.5-6.0; Fe 0.80; Cu 0.30; Mn 0.05; Mg 0.05; Zn 0.10; Ti 0.20	W,T	Intermediate strength welding wire. Cladding on brazing sheet. Architectural applications
5005	A50S, K155, R305	Si 0.40; Fe 0.70; Cu 0.20; Mn 0.20; Mg 0.50-1.10; Cr 0.10; Zn 0.25	S	Refrigerator applications
5050	50S	Si 0.40; Fe 0.70; Cu 0.20; Mn 0.10; Mg 1.0-1.8; Cr 0.10; Zn 0.25	S,W,B,T	Decorative refrigerator parts, builders' hardware and coiled tube
Alclad 5050		(same as above)	S	Better corrosion resistance than 5050
5052	52S	Si & Fe 0.45; Cu 0.10; Mn 0.10; Mg 2.2-2.8; Cr 0.15-0.35; Zn 0.20	S,W,B,T	Sheet metal work, home appliances, bus, truck and marine uses, hydraulic tubes, street light standards. Clock plates and parts. Workability and weldability good
5056	56S	Si 0.30; Fe 0.40; Cu 0.10; Mn 0.05-0.20; Mg 4.5-5.6; Zn 0.10; Cr 0.05-0.20	S,W	High strength aluminum wire, rivets, staple wire, zippers
Alclad 5056		(same as above)	W	Insect screen cloth
5086	K186	Si 0.40; Fe 0.50; Cu 0.10; Mn 0.20-0.70; Mg 3.5-4.5; Cr 0.25; Zn 0.25	S	Structural alloy with good weldability. Trailer tanks, unfired pressure vessels, towers, elevator cars and truck frames
5154	A54S	Si & Fe 0.45; Cu 0.10; Mn 0.10; Mg 3.1-3.9; Cr 0.15-0.35; Zn 0.20; Ti 0.20	S,W,B	Pressure vessels, marine use. High strength welding wire
5357	C57S K157	Si 0.12; Fe 0.17; Cu 0.07; Mn 0.15-0.45; Mg 0.8-1.2	S	Refrigerator parts, builders' hardware
6053	53S	Si 45-65% of Mg; Fe 0.35; Cu 0.10; Mg 1.1-1.4; Cr 0.15-0.35; Zn 0.10	W	Rivet wire and rivets
6061	61S	Si 0.40-0.80; Fe 0.70; Cu 0.15-0.40; Mn 0.15; Mg 0.80-1.2; Cr 0.15-0.35; Zn 0.25; Ti 0.15	S,W,B,E,T,F	Heavy-duty structures where corrosion resistance is needed. Bridge railings, marine uses, furniture, nails
Alclad 6061		(same as above)	S	Clad for better corrosion resistance and improved appearance
6062	62S	Si 0.40-0.80; Fe 0.70; Cu 0.15-0.40; Mn 0.15; Mg 0.80-1.2; Cr 0.04-0.14; Zn 0.25; Ti 0.15	E,T	Alternate for 6061
6063	63S	Si 0.20-0.60; Fe 0.35; Cu 0.10; Mn 0.10; Mg 0.45-0.90; Cr 0.10; Zn 0.10; Ti 0.10	E,T	Pipe, railings, builders' hardware, windows, store fronts and architectural uses
6066	66S	Si 0.90-1.8; Fe 0.50; Cu 0.7-1.2; Mn 0.6-1.1; Mg 0.8-1.4; Cr 0.40; Ti 0.20	W,B,E,T,F	Trailer and aircraft structures. Strength and corrosion resistance between 6061 and 2024
6151	A51S	Si 0.6-1.2; Fe 1.0; Cu 0.35; Mn 0.20; Mg 0.45-0.80; Cr 0.15-0.35; Zn 0.25; Ti 0.15	F	Intricate forgings for machine and automotive parts
6951	J51S K160	Si 0.20-0.50; Fe 0.80; Cu 0.15-0.40; Mn 0.10; Mg 0.40-0.80; Zn 0.20	S,W,B,E,T	Heat exchangers and cooling systems
7001	HZM100	Si 0.35; Fe 0.40; Cu 1.6-2.6; Mn 0.20; Mg 2.6-3.4; Cr 0.18-0.40; Zn 6.8-8.0; Ti 0.20	E,F	High strength alloy for aircraft structures
7072	72S	Si & Fe 0.7; Cu 0.10; Mn 0.10; Mg 0.10; Zn 0.8-1.3	W	Metallizing wire for sprayed coatings for corrosion protection. Cladding alloy
7075	75S	Si 0.50; Fe 0.70; Cu 1.2-2.0; Mn 0.30; Mg 2.1-2.9; Cr 0.18-0.40; Zn 5.1-6.1; Ti 0.20	S,W,B,E,F	Aircraft structures and keys. High strength alloy
Alclad 7075		(same as above)	S	Aircraft structures for improved corrosion resistance over 7075
7076	76S	Si 0.40; Fe 0.60; Cu 0.30-1.0; Mn 0.30-0.80; Mg 1.2-2.0; Zn 7.0-8.0; Ti 0.20	F	Forgings, propeller blades

Note: Other metals allowed for each alloy: Each 0.05; total 0.15

*Abbreviations:

S — Flat rolled products, sheet, strip and plate
B — Bar
T — Tube and pipe
W — Wire and rod
E — Extrusions
F — Forgings

COPPER Casting Alloys

Common Name	Nominal Composition-Per Cent	Machinability Free-cutting brass=100	Properties and Applications
ASTM specification B143			
1A Tin bronze	Cu 88; Sn 10; Zn 2 (0.35 P optional)	50	Bearings and bushings, fasteners, valve
1B Tin bronze	Cu 88; Sn 8; Zn 4	50	bodies for temperatures to 550° F.
2A Leaded tin bronze	Cu 88; Sn 6; Pb 2; Zn 4	60	Steam pressure castings, oil pumps,
2B Leaded tin bronze	Cu 87; Sn 8; Pb 1; Zn 4	60	carburetors, gears
ASTM specification B144			
3A High-leaded tin bronze	Cu 80; Sn 10; Pb 10; Ni 0.75 max	80	Bearing bronzes. Those with highest
3B High-leaded tin bronze	Cu 83; Sn 7; Pb 7; Zn 3; Ni 0.50 max	70	copper content for heaviest loads.
3C High-leaded tin bronze	Cu 85; Sn 5; Pb 9; Zn 1; Ni 0.50 max	70	Bearings, shoes, wedges, bushings and
3D High-leaded tin bronze	Cu 78; Sn 7; Pb 15; Ni 0.75 max	80	uses where an antifriction, soft ma-
3E High-leaded tin bronze	Cu 70; Sn 5; Pb 25; Ni 0.75 max	90	terial is needed. Acid resisting
ASTM specification B145			
4A Leaded red brass	Cu 85; Sn 5; Pb 5; Zn 5	90	Plumbing goods, pumps, hardware, gen-
4B Leaded red brass	Cu 83; Sn 4; Pb 6; Zn 7	90	eral purpose moderate strength cast-
5A Leaded semired brass	Cu 81; Sn 3; Pb 7; Zn 9	90	ings, ornamental objects, low pres-
5B Leaded semired brass	Cu 76; Sn 3; Pb 6; Zn 15	90	sure valves. Air, gas, oil and water fittings. Superior machinability
ASTM specification B146			
6A Leaded yellow brass	Cu 71; Sn 1; Pb 3; Zn 25	80	Same type uses as red brasses. More dif-
6B Leaded yellow brass	Cu 67; Sn 1; Pb 3; Zn 29	80	ficult to cast, but sometimes preferred for color. Ferrules, andirons, furni- ture hardware, ship trimming
ASTM specification B147			
7A Leaded high-strength yellow brass	Cu 61; Sn 0.75; Pb 0.75; Zn 35.5; Fe 1; Al 0.75; Mn 0.25	60	Heavy duty valve stems, gears, cams, bearings, hydraulic cylinder parts, ma-
8A High-strength yellow brass	Cu 58; Zn 40; Fe 1.25; Al 1.25; Mn 0.25	30	rine fittings, lever arms. Used where
8B High-strength manganese bronze	Varies to meet mechanical requirements	30	strength and toughness are required.
8C High-strength manganese bronze	Varies to meet mechanical requirements	20	Pump bodies, gas engine bases, brackets. Screw-down nuts, hydraulic cylinder parts
ASTM specification B148			
9A Aluminum bronze	Cu 88; Fe 3; Al 9	20	Strong, corrosion-resistant alloys. 9B,
9B Aluminum bronze	Cu 89; Fe 1; Al 10	35	C and D are heat treatable. Gears,
9C Aluminum bronze	Cu 85; Fe 4; Al 11	20	bushings, bearings, propellers, pickling
9D Aluminum bronze	Cu 81; Fe 4; Ni 4; Al 11	20	baskets, valve seats, marine equip- ment, worms, heavy-duty feed nuts, landing-gear parts. Good high heat strength
ASTM specification B149			
10A Leaded nickel brass	Cu 57; Sn 2; Pb 9; Zn 20; Ni 12	70	Sometimes called nickel silvers. Corro-
11A Leaded nickel bronze	Cu 64; Sn 4; Pb 4; Zn 8; Ni 20	..	sion resistant hardware, plumbing
11B Nickel leaded bronze	Cu 66.5; Sn 5; Pb 1.5; Zn 2; Ni 25	..	fixtures, ornamental castings, dairy and soda fountain equipment, musical instruments, boat and railroad car fittings, furniture and building trim
ASTM specification B198			
12A Silicon bronze	Cu remainder; Sn 1 (max); Pb 0.5 (max); Zn 5 (max); Fe 2.5 (max); Ni 1.5 (max); Al 1.5 (max); Si 1-5		Valve parts for corrosive conditions, naval hardware, chemical plant goods, brackets, pole-line hardware, clamps. Good corrosion resistance in absence of oxygen
13A Silicon brass	Cu remainder; Pb 1 (max); Zn 12-16; Si 2.5-4		
13B Silicon brass	Cu remainder; Pb 0.5 (max); Zn 12-16; Si 3-5		
No ASTM specification			
Silicon-aluminum bronze	Cu 91; Al 7; Si 2	50	Corrosion resistant. Higher strength
Silicon-aluminum bronze	Cu 90; Al 7; Si 3	50	than silicone brasses, valve bodies, radar parts, pressure castings
Beryllium bronze	Cu 96.5; Ni 1.1; Be 2.2 to 2.8	20-40	Heat treatable. Welding tips, non- sparking tools

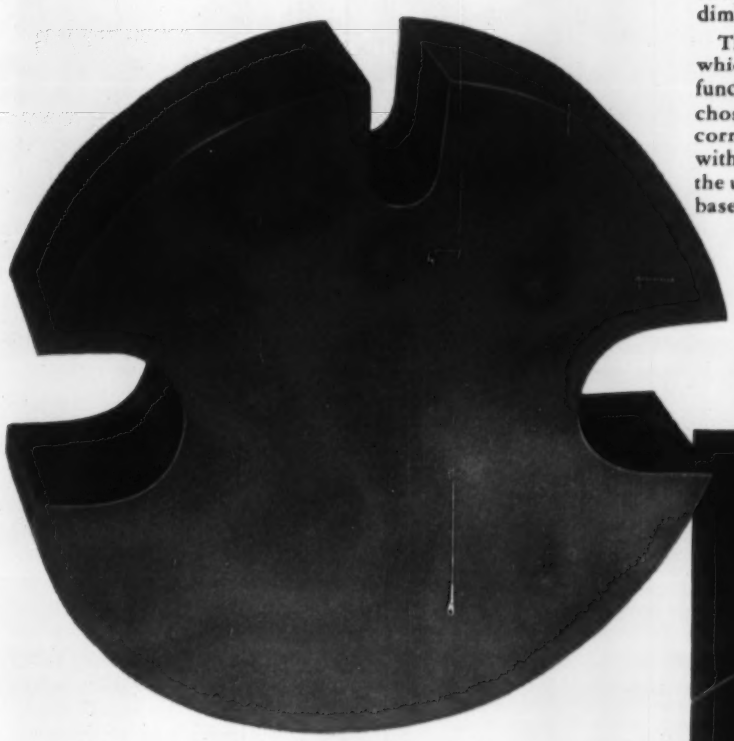
MAGNESIUM

ASTM No.	Dow Alloy	Chemical Composition (remainder is magnesium)	Forms Produced and Characteristics
AZ92A	C	Al 9.0; Mn 0.15; Zn 2.0; Cu 0.30 max	Sand and permanent mold castings. Excellent strength and good pressure tightness. Used in heat treated and aged condition for maximum yield strength
AZ63A	H	Al 6.0; Mn 0.25; Zn 3.0; Cu 0.20 max	Sand and permanent mold castings. Good toughness combined with excellent strength and elongation
EK30A	EK30A	Rare earths 3.0; Zr 0.35	Sand and permanent mold castings. For use at elevated temperatures (350–500° F). Good pressure tightness. Used mostly in heat treated and artificially aged condition
EZ33A	EZ33A	Zn 2.7; rare earths 3.0; Zr 0.7	Sand and permanent mold castings. For use at elevated temperatures (350–500° F). Good pressure tightness. Used mostly in artificially aged condition
EK41A	EK41A	Rare earths 4.0; Zr 0.6	Sand and permanent mold castings. Same as EZ33A, but used in artificially aged and in heat treated and artificially aged conditions
	HZ32XA	Zn 2.1; Zr 0.7; Th 3.0	Sand and permanent mold castings. For use at elevated temperatures (650–700° F). Good pressure tightness. Used mostly in the artificially aged condition
	HK31XA	Th 3.0; Zr 0.7	Sand and permanent mold castings. Same as HZ32XA, but used in heat treated and artificially aged condition
AZ91C	AZ91C	Al 8.7; Mn 0.15; Zn 0.7; Cu 0.08 max	Sand and permanent mold castings. Excellent strength and good pressure tightness. Used in applications requiring greater impact strength and elongation than C-T6
AZ91A	R	Al 9.0; Mn 0.20; Zn 0.6; Cu 0.08 max	Diecasting. Specification grade. Used for diecastings of good strength and ductility. Good casting characteristics
AZ91B	AZ91B	Al 9.0; Mn 0.20; Zn 0.6; Cu 0.25 max	Diecasting. Standard grade. Used for diecastings of good strength and ductility. Good casting characteristics
AZ31A	FS1	Al 3.0; Mn 0.45; Zn 1.0	Extrusions and sheet. Most commonly used alloy for extrusions and sheet. Good formability and weldability
AZ61A	J1	Al 6.5; Mn 0.20; Zn 1.0	Extrusions. Improved strength over FS1—but with less formability
M1A	M	Mn 1.2	Extrusions and sheet. For use where strength requirements are not severe and where stress relief after welding is not possible
ZK60A	ZK60A	Zn 5.7; Zr 0.55	Extrusions. Highest strength, used mostly in artificially aged condition. Good toughness

HEAVY EXTRUDED SHAPE

Saves Over 25¢ per lb.

FOR THE STRONG ELECTRIC CORP.



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COPPER AND BRASS INCORPORATED

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Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

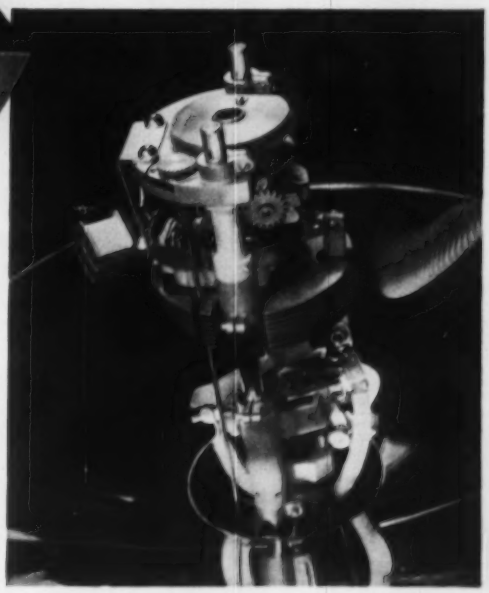
The unusual thing about this copper extruded shape is that it saves money in first cost as well as in machining time. The double economy amounts to over 25¢ per pound. The large illustration shows the shape as supplied in the form of a slug or pre-formed disc, 1 1/16" x 5". This begins as a long extrusion, from which Revere cuts the discs, and pickles them before shipping.

The customer is The Strong Electric Corp., Toledo 2, Ohio, which originally tried plate and bar, but found costs were too high. Revere Product Engineers, Methods and Production Departments collaborated with the company on the problem, and were able to develop the unusually heavy and economical shape. Strong reports a number of savings. One is that the shape is machined quickly and perfectly, with almost no rejects. This is due to the denseness and uniformity of the metal, a result of the high pressures exerted during extrusion. (Finishing operations include drilling bolt holes and cutting cooling fins.) As a secondary result of improved machining, the customer does not have to keep large inventories of metal to take care of spoilage, nor handle large quantities of scrap. Further, Revere supplies the discs in the correct thickness, eliminating a cutting-off operation for Strong. Incidentally, we are glad to supply shapes cut to dimensions, or in long lengths, as desired.

The completed part is an obturator-probe, which fulfills a control and heat dissipation function in a powerful searchlight. Copper was chosen for its ability to conduct heat and resist corrosion. Revere will be glad to collaborate with you in your search for economies through the use of extruded shapes in copper and copper-base alloys, and aluminum alloys.

Copper Extruded Shape, 1 1/16" x 5", as furnished.

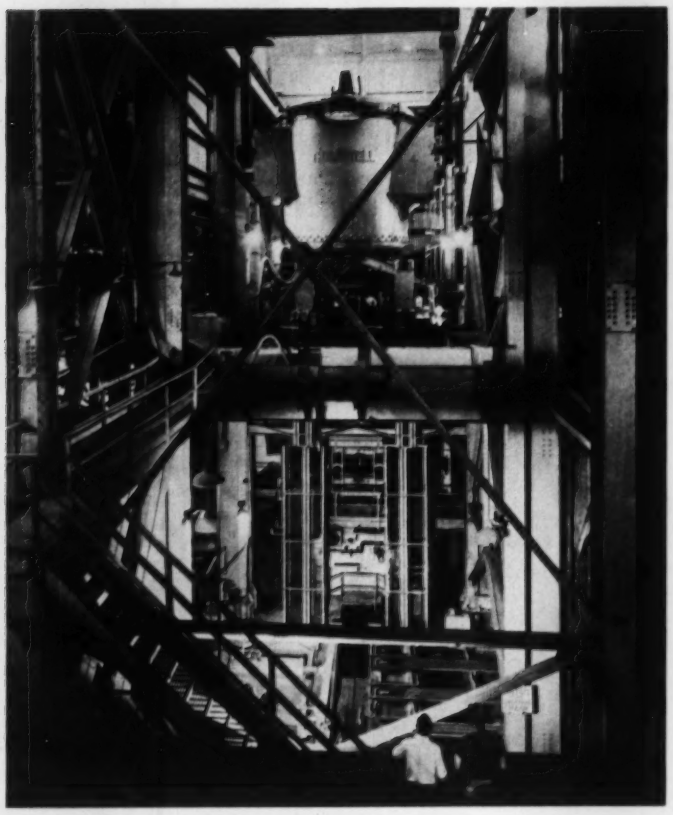
Shape in place in a carbon arc searchlight mechanism.



Continuous Casting . . .

A Year of Progress

Two-shift operation soon will grow to three at Atlas as first commercial machine has an anniversary. Operating data are piling up; so are profit prospects



OPERATION of the first commercial continuous casting machine at Atlas Steels Ltd., Welland, Ont., was top news a year ago (STEEL, Nov. 8, 1954, page 88).

Since then, you have heard rumors of equipment breakdowns, even economic failure.

To get at the facts, STEEL interviewed operating and management officials at Atlas.

Here is what they report:

Q: Has continuous casting proved to be anything less than you anticipated?

A: Not in the slightest. We fully expected to encounter difficulties, and we did. The limitations and disadvantages of pioneering the operation were fully known beforehand.

In the first place, knowledge is limited and hard won. Every time a different composition or size is to be cast, all data have to be collected through operations. In our case, where we produce up to 150 different alloys every month, earlier savings are constantly being re-invested in experiments.

Size of sections was limited at first, but this is rapidly being eliminated. We still are limited in casting speed by the cutoff mechanism. Optimum melt shop scheduling won't be achieved until the whole shop is designed around the casting machine. Then there's refractory wear caused by higher temperatures and longer ladle times.

These things were all anticipated while the machine was still on paper.

Q: Then the "birth pains"

Yield Comparisons

Continuous Casting

Cold weight charged	53,377 lb
Tapped weight sent to casting machine	51,165 lb
Melting yield	96 per cent
Losses at casting machine	
Left in tundish	300 lb
Bottom discard	200 lb
Test metal	150 lb
Ladle skull	400 lb
Billets to the mill	50,115 lb
Casting yield	98 per cent
Products rolled from cogged material	47,450 lb
Cogging yield	94.5 per cent
Total yield from cold metal to billets	88.9 per cent

Conventional Processing

(To determine melting yield, every ingot from several months of production was weighed accurately instead of estimating.)

Normal melting yield—92 per cent
Short ingots or butts—1½ to 2 per cent

Billet yield—78.6 per cent

Over-all yield—72.5 per cent

(Compare this figure with the 77 per cent budget standard yield obtained when *estimating* individual ingot weights)

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Designed and Built by MESTA

MESTA 60" SHEET SHEARING LINES
WITH TRIMMERS AND COMBINATION
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* *HIGH-SPEED SHEARING,*
SIDE TRIMMING
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FOR SHEET AND
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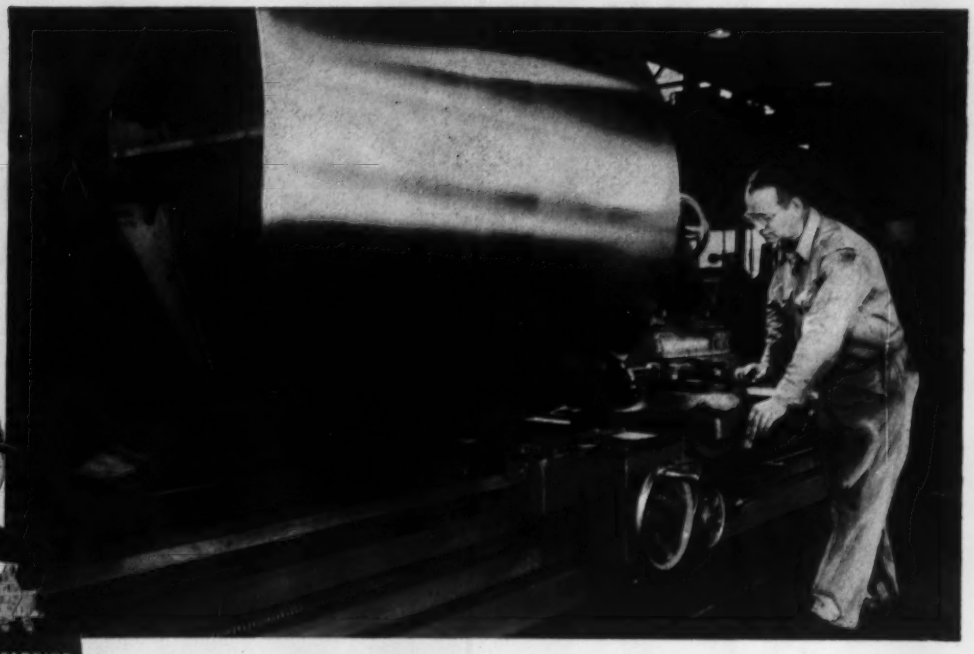
MESTA MACHINE COMPANY

PITTSBURGH, PENNSYLVANIA



Photo, courtesy Commercial Machining Company, Conway, Pa. Turning 60" dia. stainless steel looping line roll.

Mr. Tooley Says:

"There's more than one way to skin a cat"

CIRCLE "C"

SUPER HIGH SPEED STEEL

- Operating speeds 25%—50% faster than ordinary high speed steels
- Longer tool life
- Cuts costs by increasing production
- Particularly suitable for cutting tough alloy and stainless steels

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- Highest metal removal rate
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- Large stocks of standard tools and tips for immediate delivery
- Mechanically-held and brazed designs

Yes, in the field of tooling, alternative cutting materials make it possible to utilize the same production equipment for a variety of applications. In typical turning operations either Firth Sterling High Speed Steel or Firthite Sintered Carbide cutting tools may be selected . . . depending upon the characteristics of the metal and the production requirements of the job.

Firth Sterling, manufacturers of complete shop tooling needs, occupies the unique position of providing *both* steels and carbides to "skin the cat" of production in the most economical and effective ways. Thus, from *one* dependable source of supply you are assured of (1) completely unbiased tooling recommendations and, (2) the selection of the exactly right carbide or steel or *both* to provide maximum production!

Both Firth Sterling's famous CIRCLE "C" Super High Speed Steel and FIRTHITE Sintered Carbide cutting tools and tips are used alternatively for most metal removal operations. Write now for literature and unbiased recommendations for your specific needs.

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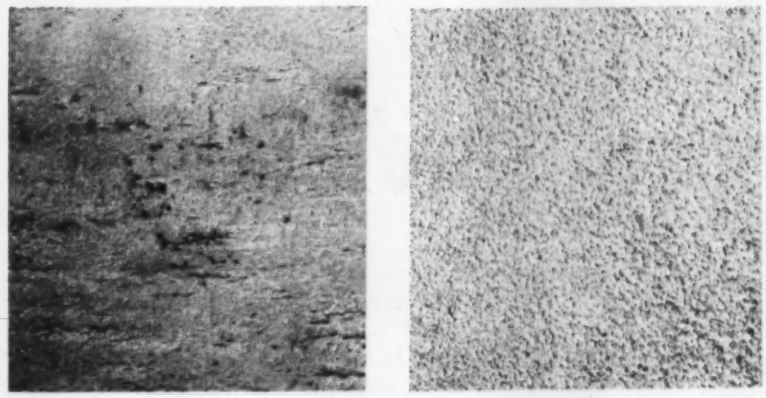
CALL YOUR FIRTH STERLING DISTRICT OFFICE OR DISTRIBUTOR. ASK MR. TOOLEY.



Surface of cast slabs is so good that no conditioning need be performed. Cogged surface at left was quickly shotblasted to that in right-hand photo

weren't really any worse than you figured they would be?

A: That's right. We knew we would have to develop our background data, men and techniques from scratch. Consequently, even now our operational schedules are laid out to provide the largest percentage of our time for production casting and the rest for development work on new grades and sizes.

Q: Is any element—data, men or technique—more important than any other to the success of the process?

A: If there is any single element that is most vital, it is time. Since our first experimental cast 18 months ago, we have accumulated a wealth of experience that enables us to produce a commercial product today. We also have had time to appreciate the size and complexity of the task to which we have set ourselves.

Of the three factors, however, only two are affected by time . . . men and data. We have two crews trained as operating teams, and a third crew soon will be ready to make casting an around-the-clock operation. Data, of course, have been accumulating all the while.

Q: What compositions and sizes have been cast this past year?

A: The table gives a good idea of the different grades with which we have been working. As to sizes, we have cast mainly into 5½ x 7½-in. and 5½ x 21½-in. molds, with the bulk going into the larger size because it best fits our sheet and strip requirements. While we are not prepared to release tonnage figures, the 300 and 400 series stainless steels have been the biggest tonnage items.

Q: Has there been any trouble meeting physical and metallurgical requirements?

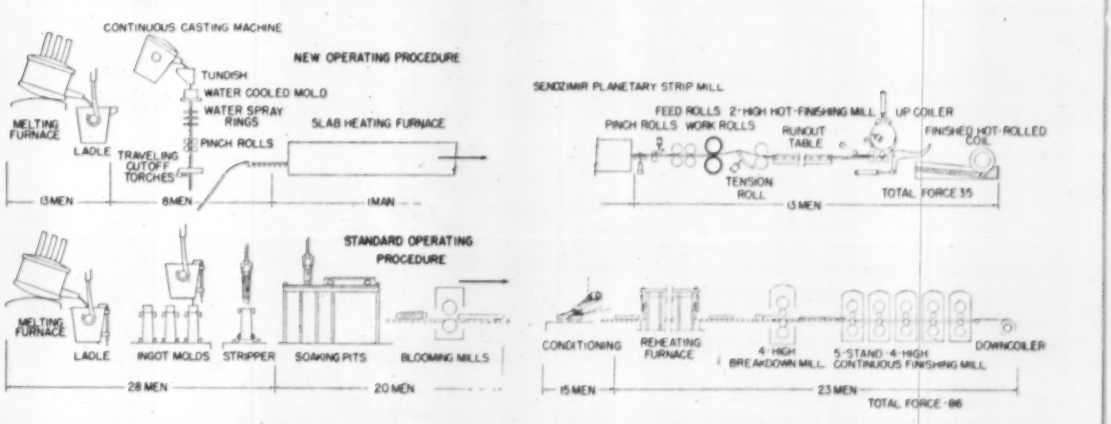
A: None that we didn't expect to encounter. In fact, we were agreeably surprised to find that anticipated segregation problems were neither severe nor difficult to solve. We have yet to encounter the quality problem that can be attributed to continuous casting.

Q: We've heard that some of the other pioneers in continuous casting are having trouble with internal grain structure irregularities. Have you?

A: In the early stages of equipment and again during the early operating days, most of the castings made were of unsuitable quality. Most were rejected because of poor cast structure, primarily due to a faulty center.

The early stages of casting show a characteristic dendritic pattern. As pouring progresses and the temperature drops, this pattern changes abruptly from dendritic to equiaxed, caused by a combination of lower metal temperatures and rapid billet cooling.

In pouring later heats, the temperature and cooling rates were adjusted to favor the solidification with the equiaxed crystals throughout the section. We changed our practice to provide adequate cooling immediately below the mold and promote rapid solidification, followed by less drastic cooling. The latter allowed residual heat



How well continuous casting stacks up in manpower requirements is apparent. The planetary hot strip mill also is being pioneered at Atlas

You name it–we'll TAPE it!

The trend in metal processing is toward *automation*—and tape application is no exception. There are now more than 75 different manual, semi-automatic and automatic dispensers available for "SCOTCH" Brand Tapes. These basic types lend themselves to an infinite variety of adaptations. Chances are, wherever you use (or *could* use!) tape, our Customer Engineering Service Department can provide a dispenser that will enable you to enjoy many cost-saving, production-speeding benefits. If they don't have the dispenser you need, they'll be glad to design one without cost or obligation.

FLAT-SURFACE APPLICATOR automatically applies predetermined lengths of tape to moving objects at production speed of better than a unit a second.

See you at booth 1668
37th National Metal Exposition and Congress, Philadelphia, October 17-21

. . . Manually

1. HAND APPLICATION of tapes can be made easier with proper dispensers. Above: "SCOTCH" Brand Filament Tape used to seal and reinforce shipping carton is applied from easily loaded dispenser. A flick of the wrist cuts tape to desired length.

2. PACKAGING OPERATIONS can be speeded by specially designed dispensers. Above: "SCOTCH" Brand P-35 Dispenser applies strip of tape around twisted neck of polyethylene bag; leaves tape tab for price; gives quick, clean cut-off with no tape waste.

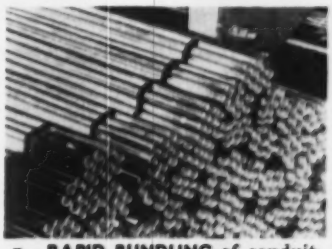
. . . Semi-Automatically

3. EASY WAY TO WRAP a bulky bundle: As automobile bumper is lowered into wrapping cradle, battery of air-operated dispensers deliver predetermined lengths of "SCOTCH" Brand Filament Tape to workers. Fast, efficient wrapping at production line speeds.

4. SPECIAL DISPENSERS solve special problems. Above: "SCOTCH" Brand Lane Marking Applicator applies "SCOTCH" Colored Plastic Tape on floor to mark lanes, indicate storage areas etc. Roller presses tape down firmly for tight, long-lasting bond.

. . . Fully-Automatically

5. APPLICATION of "SCOTCH" Brand Masking Tape to aluminum strips is handled by this applicator custom-designed by our service department. Strips are masked for protection during drilling and boring operations; dispenser does it at production speeds.



6. RAPID BUNDLING of conduit, rigid-wall pipe, and bar stock with the Guide Company Bundler, Model CG. Machine secures bundles at each end with "SCOTCH" Filament Tape; handles three a minute. (Manufactured by Guide Company, Canfield, Ohio.)

DISPENSERS *for* SCOTCH BRAND

Reg. U.S. Pat. Off.

Pressure-Sensitive Tapes

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MINNESOTA MINING AND MFG. CO.
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Please send me complete information on the types of dispensers checked:

1___ 2___ 3___ 4___ 5___ 6___

___Would like a survey of my plant to see where automatic tape applying equipment can cut my costs . . . speed production.

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CM LODESTAR ELECTRIC CHAIN HOIST
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Rugged lightweight hand hoists and pullers...to make your job easier and safer

CM CYCLONE HAND HOIST
¼ to 10 ton capacities—Easy to carry and lift. One ton model weighs only 36 pounds. Made of tough aluminum alloy. CM-Alloy load chain. High efficiency. Lifetime lubrication.

CM PULLER THE "ONE MAN GANG"
¾ to 6 ton capacities—Lifts or pulls at any angle. Lever handle operation. Automatic load brake holds at any point. ¾ ton model weighs only 13 pounds. CM-Alloy flexible load chain.

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in the casting to release the cooling stresses which cause the internal hot tearing.

Q: If you were to start over with the knowledge and experience you have gained, what changes in plant or equipment would be evident?

A: If the casting machine were to be installed in an existing plant, about all we would do is install the equipment closer to the steel production units. But if we were designing a whole new plant, it would most likely be similar in layout to the one in the accompanying drawing. Then, too, we would want to incorporate some of the minor changes we have made on the machine itself, if they prove worth-while.

Q: Can you discuss, even in general terms, the cost picture as you've found it?

A: We have some most interesting cost analyses, but unfortunately not for release. In general, increased yield is the biggest factor on the credit side of the ledger. How we arrive at some of our yield gains is brought out in the accompanying material (see box).

Our pit and hot top cost averages about $8 a ton. To equal that rate with the casting machine, we should cast about 2500 tons of metal a month. At that figure and over, the melt shop begins to realize all the yield savings.

Q: What about the savings in manpower and process time. Aren't they sizable factors, too?

A: They certainly are, but being an alloy producer, the increased yield looks especially good to us.

A carbon steel producer, however, would be more interested in the low capital investment, the more direct route to the finishing facilities and the fewer men it would take to produce finished steel. Yield won't be quite so important to him as it is to us.

We can now say, for instance, that elimination of the blooming mill is possible. Many experiments have been run with cast slabs being rolled immediately to hot bands with no prior working. Results are promising.

Will Vacuum Melted Metals do for YOUR Product what they do for Jet Planes?

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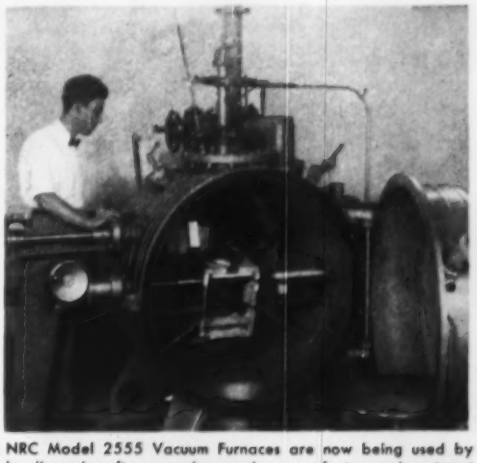

NRC Model 2555 Vacuum Furnaces are now being used by leading aircraft companies, engine manufacturers, investment casters, specialty steel producers to speed up the development of new materials that will meet ever more severe operating requirements.

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AIR engineering at work
REPORT No. 4400.05

Running Ten Nuts at a Crack...

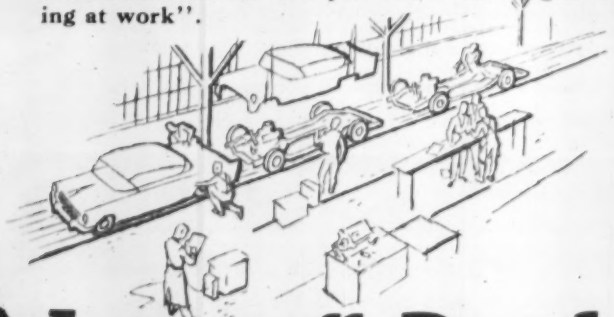
SAVES $12,000 *a year!*

This large auto manufacturer formerly used two ¼ ton presses to position a differential carrier in the rear axle housing. Then the ten ⅜" nuts were run individually. Only experienced operators could control torque so that it met specifications. Naturally the engineers wanted to eliminate the press operation and improve torque control.

AIR engineering by Ingersoll-Rand provided the answer and saved $12,000 a year. A 10-Spindle Multiple Nut Runner is now suspended over the moving conveyor. The differential carrier is hand set on the housing, and dropped to within ⅛" of its final location. The 10-spindle nut runner quickly and accurately draws it into final position as it runs all 10 nuts at once . . . and to the required 50 ft. lbs. torque. The press operation is eliminated, and simultaneous running of the nuts eliminates binding.

If you are in any way responsible for cutting costs in your plant, write us on your company letterhead, and we will arrange for you to see I-R's confidential manual of reports on "AIR engineering at work".

Ingersoll-Rand Multiple Nut Runner runs 10 nuts at once, all to exact torque.



Ingersoll-Rand

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AIR engineering Manual

Don't miss over 100 interesting case history applications of AIR engineering in this confidential manual.

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Seminar on Theory of Alloy Phases

Ben Franklin Hotel

Co-ordinator—Paul A. Beck, University of Illinois

Saturday, Oct. 15—9:30 a.m.

Bonding Forces in Solids—Fred Seitz, University of Illinois.

Band Theory of Bonding in Metals—J. C. Slater, Massachusetts Institute of Technology.

Density of States as Determined by Soft X-Ray Spectroscopy—C. H. Shaw, Ohio State University.

Saturday, Oct. 15—2 p.m.

Intermediate Phases and Electronic Structure—T. Massalski, University of Chicago.

Crystal Structure and Atomic Size—F. Laves, Polytechnic Technical Institute, Zurich, Switzerland.

Bonding Forces in Alkali Metals—Dr. H. Brooks, Cruft Laboratory, Harvard University.

Saturday, Oct. 15—8 p.m.

The Electronic Structure of Metals and Alloys—L. Pauling, California Institute of Technology.

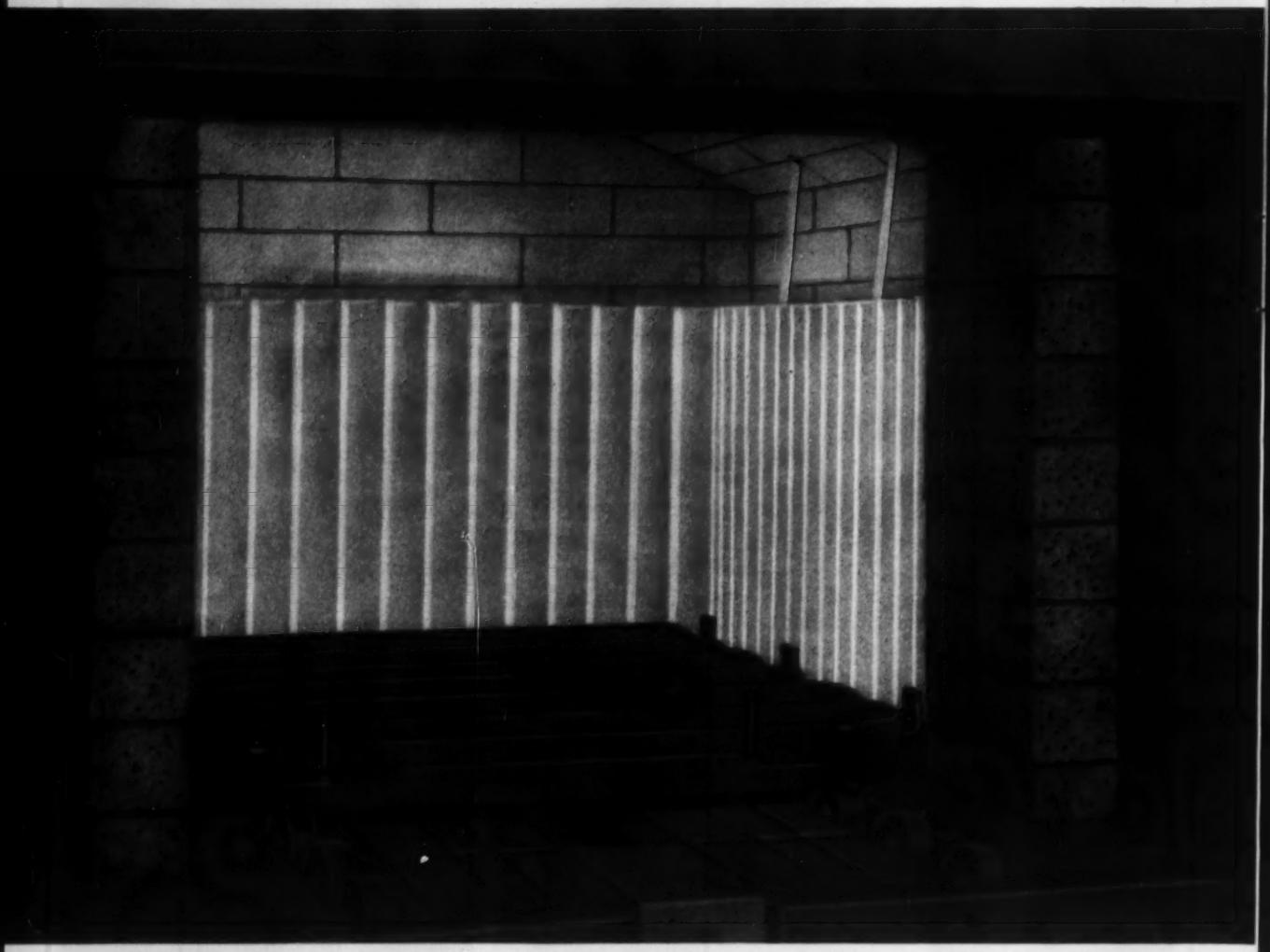
Sunday, Oct. 16—9:30 a.m.

Intermediate Phases in Alloys of the Transition Elements—Pol Duwez, California Institute of Technology.

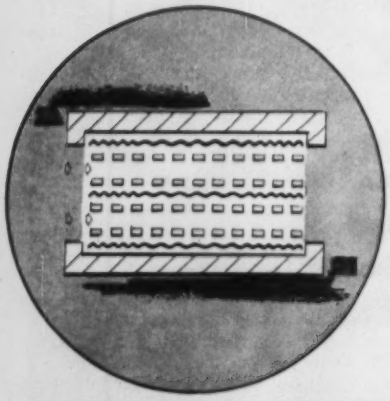
Ferromagnetism, Antiferromagnetism and Crystal Structure—Clarence Zener, University of Chicago.

Atomic and Magnetic Ordering in Intermediate Phases—J. S. Kasper, General Electric Co.

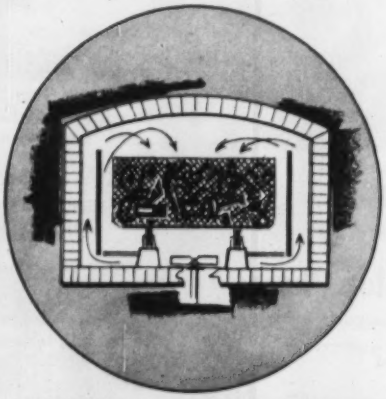
BRAND NEW–MODERN ELECTRIC ELEMENT



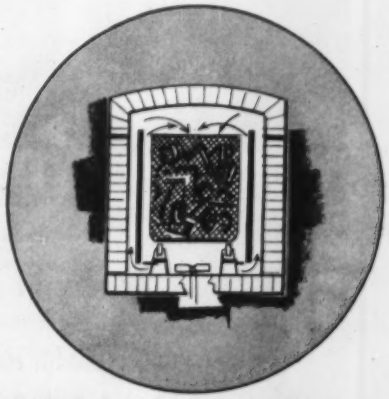
This shows graphically how the new Lindberg CORRTHERM electric heating element actually fills the furnace with walls of glowing heat. Note also that CORRTHERM is conveniently hung from simple brackets requiring no complicated connections or construction. This element operates at extremely low voltage, eliminating shock or short hazards.



In continuous type furnaces CORRTHERM elements hang between lines of work as well as on side walls. Note how closer corrugations (at each end of element) compensate for incoming cold work and door losses.

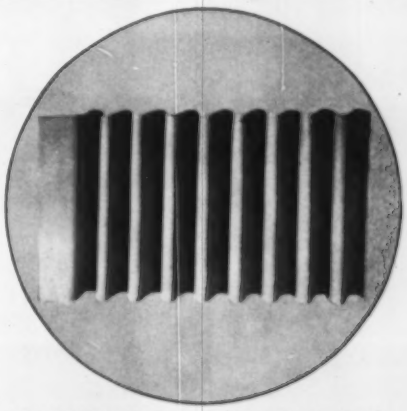


CORRTHERM elements act as natural baffles to direct forced convection streams through the charge. The use of electric furnaces for carburizing and carbonitriding now becomes completely practical.



No retort needed in pit-type carburizing furnace with CORRTHERM elements. Again see how elements serve as baffles to direct forced convection stream through charge.

FOR LINDBERG FURNACES



CORRTHERM elements are large sheets of corrugated nickel chromium. They were developed in Lindberg laboratories by Lindberg metallurgists and engineers.

Never before has there been an electric heating element like this CORRTHERM by Lindberg. Its revolutionary advantages now make the use of electricity as the source of heat, practical, efficient and economical for all heat treating processes.

Ideal for use in any electric heat treating furnace, CORRTHERM elements have particular advantages for carburizing and carbonitriding. This new element completely eliminates problems formerly created by the use of electricity in these types of furnaces. These exclusive advantages of CORRTHERM explain how and why:

LOW VOLTAGE: Operates at extremely low voltage. No leakage through carbon saturation. Around Lindberg we talk about it as the electric element "without any electricity . . . to speak of!"

ATMOSPHERE CIRCULATION: Elements act as baffles to direct circulation of convection streams.

SAFETY: Extremely low voltage also eliminates shock or short hazards.

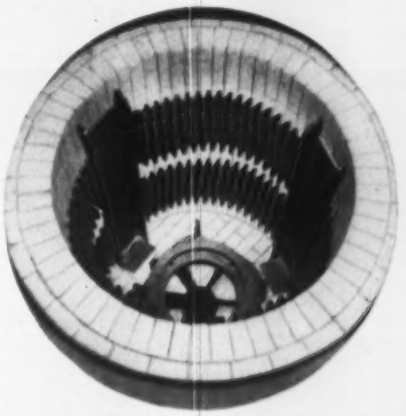
DURABILITY: Watts density at all-time low. Element practically indestructible. Work load or operator's charging tool can't hurt it.

EASILY INSTALLED: Element is not enclosed, just hangs in furnace. No complicated mountings required.

If electricity is the preferable source of heat for your metal treating processes find out how advantageously CORRTHERM elements can be applied to your requirements. Just get in touch with your nearest Lindberg Field Representative. (Consult your classified phone book.)

This shows installation of CORRTHERM elements in one of two large rotary furnaces currently being erected in the field by Lindberg's associate company, Lindberg Industrial Corporation.

See CORRTHERM at ASM Show. The new CORRTHERM element will have its first public showing at the ASM Show in Philadelphia, October 17 to 21. Plan to see this and many other new developments by Lindberg in the furnace and related fields in the Lindberg Booth No. 230.



An installation of CORRTHERM elements in a carburizing pit-type furnace. Simplicity of mounting makes replacement easy and economical.

LINDBERG ENGINEERING COMPANY

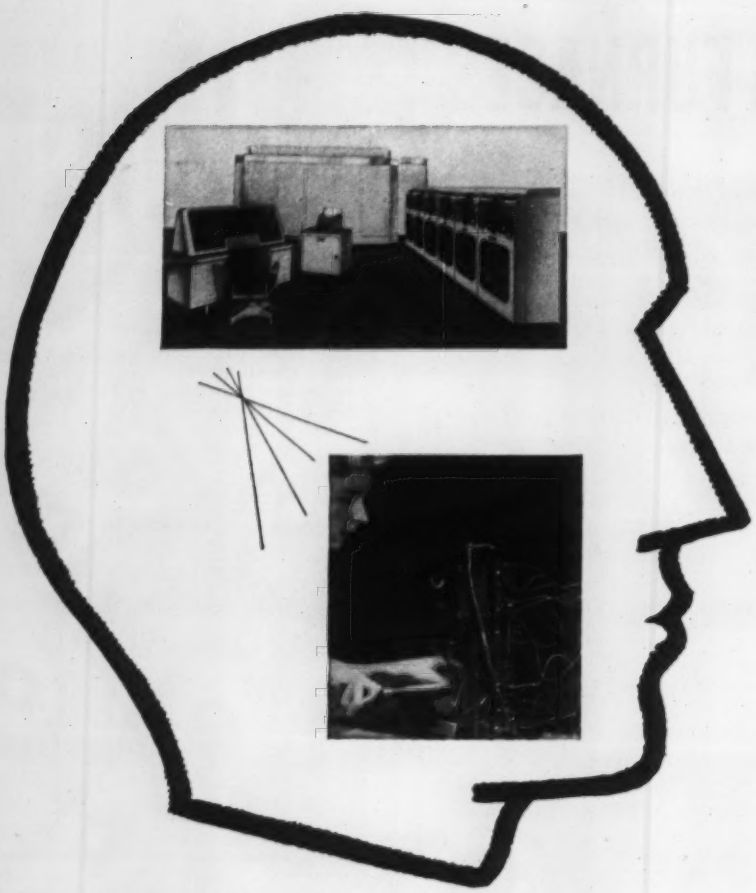
2441 West Hubbard Street, Chicago 12, Illinois

Los Angeles Plant: 11937 Regentview Ave., at Downey, California

Safety! Extremely low voltage makes CORRTHERM elements completely safe. Let operator or work load bang it if they will. Neither element nor operator will be hurt.

CORRTHERM

by LINDBERG



Metal ganglions for the mechanical brain

The nerve centers of modern electronic computers are the points of contact that permit the flow of electrical current from part to part. These points of contact must be firmly and permanently joined. Usually, delicate soldering operations are used for this purpose.

The electronics industry requires many tons of fine solders. The Federated Metals Division of American Smelting and Refining Company is a major producer of these solders.

Federated solders are the result of many years of research and development. Typical of advances made by Federated research are patented Castomatic bar and ingot solders. Made on automatic casting machines, controlled by electronic instruments, each bar or ingot is identical in size, shape and weight, with uniform composition unequalled by other methods of casting. Every bar gives the same results in the user's hand.

No matter what size, shape or composition you may need in a solder, think of Federated first as a source of supply. Our broad experience with all kinds of non-ferrous metals has earned us the name of Headquarters for Non-Ferrous Metals.

Federated Metals

DIVISION OF AMERICAN SMELTING AND REFINING COMPANY
120 BROADWAY, NEW YORK 5, N. Y.
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Federated first in the non-ferrous field — AMD

Aluminum, Anodes, Babbitts, Brass, Bronze, Die Casting Metals, Lead, Lead Products, Magnesium, Solders, Type Metals, Zinc Dust

ASM PROGRAM

Sunday, Oct. 16—2 p.m.

Atomic Moments of Transition Elements in Solid Solution Alloys—C. Shull, Massachusetts Institute of Technology.

Solid Solutions and Ordering—B. Averbach, Massachusetts Institute of Technology.

Alloy Phase Diagrams—G. V. Raynor, Birmingham University, England.

TECHNICAL PAPERS

Monday, Oct. 17—9:30 a.m.

Titanium

The Rate of Diffusion of Carbon in Alpha and Beta Titanium—F. C. Wagner, E. J. Bucur and M. S. Steinberg, Horizons Inc.

Hydrogen Contamination in Descaling and Acid Pickling of Titanium—G. A. Lenning, C. M. Craighead and R. I. Jaffee, Battelle Memorial Institute.

Mechanical Properties of Ti-Cr-Mo-Alloys as Affected by Grain Size and Grain Shape—H. R. Ogden, F. C. Holden and R. I. Jaffee, Battelle Memorial Institute.

Investigation of the Heat Treatability of the 6%-Aluminum 4%-Vanadium Titanium-Base Alloy—R. G. Sherman, H. D. Kessler, Titanium Metals Corp. of America.

Mechanical Properties

Notch Ductile High Strength Nodular Irons—G. A. Sandoz, H. F. Bishop and W. S. Pellini, Naval Research Laboratory.

Fatigue and Anisotropy in Copper—M. L. Ebner and W. A. Backofen, Massachusetts Institute of Technology.

The Influence of Vibration on the Solidification of an Aluminum Alloy—R. S. Richards, Titanium Metals Corp.; and W. Rostoker, Armour Research Foundation.

Monday, Oct. 17—2 p.m.

Titanium-Zirconium

Nature and Decomposition Kinetics of Alpha Prime in Titanium-Vanadium Alloys—F. R. Brotzen, Rice Institute; E. L. Harmon and A. R. Troiano, Case Institute of Technology.

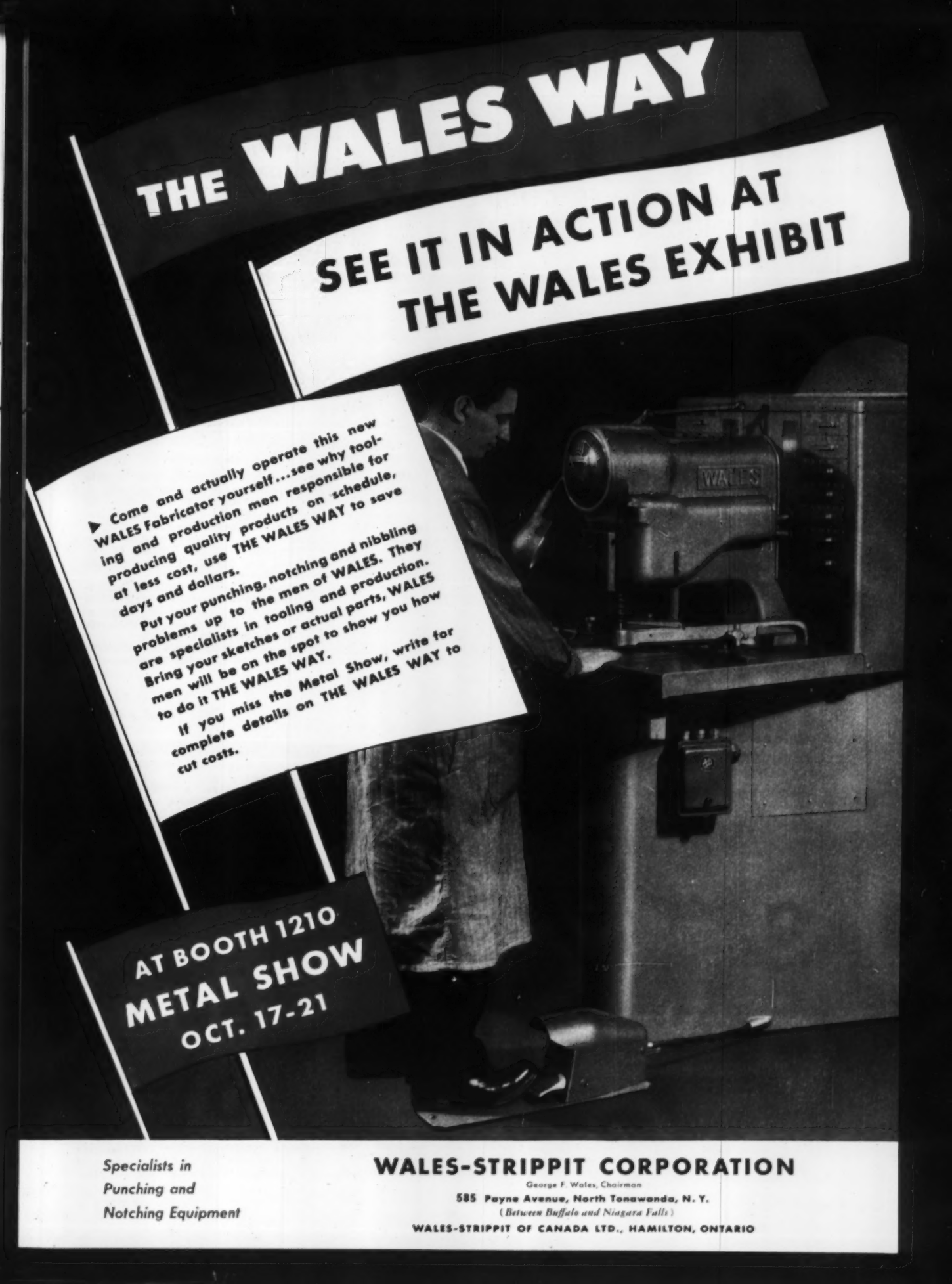
Metallography of Tempering of Alpha-Prime in Titanium Alloys—R. F. Domagala and W. Rostoker, Armour Research Foundation.

Tensile Properties of Zircomium-Chromium Alloys: Particle-Strengthening Effects—J. H. Keeler, General Electric Co.

Progress in the Development of Creep-Resistant Zirconium Alloys—Walston Chubb, Battelle Memorial Institute.

THE WALES WAY

SEE IT IN ACTION AT THE WALES EXHIBIT



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Put your punching, notching and nibbling problems up to the men of WALES. They are specialists in tooling and production. Bring your sketches or actual parts, WALES men will be on the spot to show you how to do it THE WALES WAY.

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OCT. 17-21

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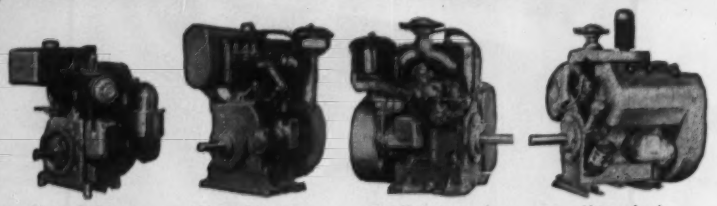
WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONTARIO

Most Specified as

STANDARD POWER COMPONENTS ON ORIGINAL EQUIPMENT . . .

WISCONSIN HEAVY-DUTY Air-Cooled ENGINES



Single Cylinder 3 to 8¼ hp. | Single Cylinder 6 to 9 hp. | Two-Cylinder 7 to 15 hp. | V-type 4-cyl. 15 to 36 hp.

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Specified by leading "blue chip" builders of farm and orchard equipment for: combines, pickup balers, forage harvesters, garden tractors, field crop and orchard sprayers, irrigation pumping units, portable elevators and many other machines.

Wisconsin-powered Model 87 New Holland Baler.

IN THE CONSTRUCTION FIELD...

Specified for leading makes of concrete mixers, concrete finishers, concrete cutters, power "wheelbarrows", hoists, bituminous spreaders, ditch diggers and trenchers, road rollers, conveyors, compressors, arc welders, pumping units, standby electric generators, etc.

Wisconsin-powered Smith DeLuxe Truck Mixer.

IN THE OIL FIELD...

Widely specified as integral power for many types of oil field utility units such as oil well pumps, gathering pumps, dope kettles, pipe straightening machines, compressors, salt water disposal pumps, trenchers, standby power units, etc.

Wisconsin-powered Oil Field Booster Pump.

IN THE INDUSTRIAL FIELD...

Specified for plant floor sweepers and scrubbers; fork-lift, pallet and platform trucks; plant fire-fighting equipment; truck and trailer refrigeration systems; power lawn mowers and leaf sweepers and a great variety of specialized applications in many fields.

Wisconsin-powered Hyster Fork Lift Truck.

Because Wisconsin Heavy-Duty Air-Cooled Engines match the equipment of which they become integral units . . . because they fit both the machine and the job with maximum power advantage and minimum maintenance cost . . . these fine engines merit the serious consideration of design engineers and builders of equipment utilizing engine power within a 3 to 36 hp. range. Write for Bulletin S-179 and tell us about your power problem.

WISCONSIN MOTOR CORPORATION

World's Largest Builders of Heavy-Duty Air-Cooled Engines

MILWAUKEE 46, WISCONSIN

ASM PROGRAM

Tuesday, Oct. 18—9:30 a.m.

Tempering of Steel

Some Effects of Silicon on the Mechanical Properties of High-Strength Steels—C. H. Shih, B. L. Averbach and Morris Cohen, Massachusetts Institute of Technology.

Some Relationships Between Endurance Limit and Torsional Properties of Steel—S. T. Ross, R. P. Sernka and W. E. Jominy, Chrysler Corp.

The Influence of Molybdenum and Tungsten on Temper Embrittlement—A. E. Powers, Materials & Processes Lab., General Electric Co.

Hardness of Tempered Martensite in Carbon and Low-Alloy Steels—R. A. Grange, Fundamental Research Laboratory, and R. W. Baughman, United States Steel Corp.

Deformation

Deformation of Beryllium Single Crystals at 25 to 500° C—H. T. Lee and R. M. Brick, School of Metallurgical Engineering, University of Pennsylvania.

Grain Boundary Creep in Aluminum Bicrystals—F. N. Rhines, W. E. Bond and M. A. Kissel, Carnegie Institute of Technology.

Deformation and Fracture Mechanisms of Polycrystalline Magnesium at Low Temperatures—F. E. Hauser, P. R. Landon and J. E. Dorn, University of California.

Influence of Cold Work on Strength of Steel at Elevated Temperatures—Paul Shahinian, Naval Research Laboratory.

Tuesday, Oct. 18—2 p.m.

Steel

Inhibition by Nitrogen of Graphitization in Steel—G. V. Smith, Cornell University, and B. W. Royle, American Steel & Wire Division, United States Steel Corp.

An Approach to the Study of the Effect of Rare-Earth Additions to Steel by Use of Radioactive Tracer Techniques—C. S. DuMont, J. E. Gates, Battelle Memorial Institute, and C. N. Henderson, Mallinckrodt Chemical Works.

The Optimum Boron Content for Hardenability—J. C. Shyne, E. R. Morgan and D. N. Frey, Ford Motor Co.

On Banding in Steel—C. Jatczak, D. J. Girardi and E. S. Rowland, Timken Roller Bearing Co.

Wednesday, Oct. 19—2 p.m.

Steel

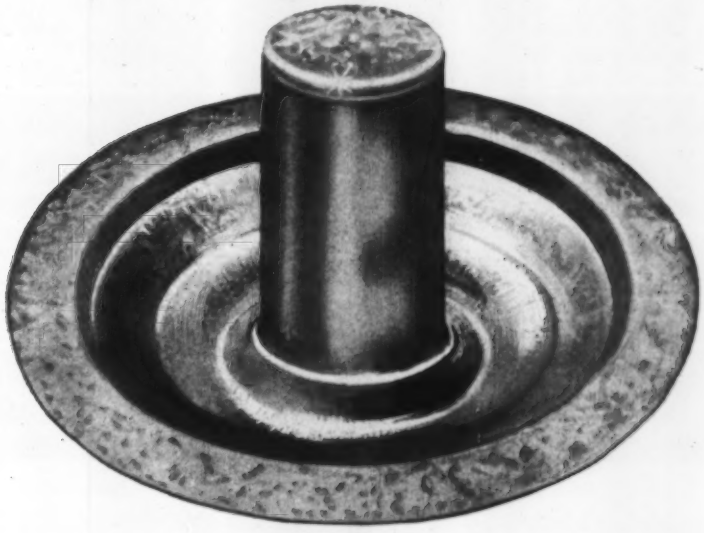
Some Effects of Metal Removal and Heat Treatment on the Surfaces of Hardened Steel—Karl E. Beu, Goodyear Atomic Corp., and Donald P. Koistinen, General Motors Corp.

Effect of Temperature on Delayed Yielding of Mild Steel for Short Loading Duration—Josephy M. Krafft, Naval Research Laboratory.

Effect of Tempering Temperature on Stress Corrosion Cracking and Hydrogen Embrittlement of Mar-

A CHALLENGE:

THE STRONGEST MADE BY ANY GALVANIZED SHEET —



Anything that can be made of steel sheets can be made of

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galvanized sheets!

THIS is a muffler head made of Wheeling SOFTITE Galvanized Sheets. Notice the severe draw, the intricate bends and folds. Now see how tightly the coating clings to the base metal. No cracks, no flakes, no strain.

That's because Wheeling SOFTITE has the tightest zinc coating yet produced...so tight, in fact, that you can use it to make anything you can make of steel sheets.

That's SOFTITE...*Wheeling* SOFTITE...made by the company that led with the development of COP-R-LOY, the original copper-bearing steel pipe and perfected DUCTILLITE, the original cold reduced tin plate which revolutionized the tin plate industry, and opened new fields to the can maker and packer. Now, because of the unprecedented demand for SOFTITE Galvanized Sheets, Wheeling has been forced to triple its production facilities in 1955.

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Phone your Bunting Distributor before you start an endless search or commence costly machining of an unusual bearing. It is often easy to alter a Bunting Standard Stock Bearing to fit extraordinary applications. Also services of expert Service Machine Shops maintained in Bunting Branches are instantly available through your Bunting Distributor.

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BRANCHES IN PRINCIPAL CITIES

ASM PROGRAM

tensitic Stainless Steels—Peter Lillys and A. E. Nehrenberg, Crucible Steel Co. of America.

Static Fatigue of High-Strength Steel—R. H. Raring and J. A. Rinebolt, Naval Research Laboratory.

Molybdenum-Vanadium-Tantalum

The Initiation of Discontinuous Yielding in Ductile Molybdenum—J. A. Hendrickson, D. S. Wood and D. S. Clark, California Institute of Technology.

Properties of Vanadium Consolidated by Extrusion—C. E. Lacy and C. J. Beck, General Electric Co.

The Mechanical Properties of Vanadium-Base Alloys—W. Rostoker and A. S. Yamamoto, Armour Research Foundation; R. E. Riley, Rem-Cru Titanium Corp.

Rolling Textures in Tantalum in Relation to BCC Metals—J. W. Pugh and W. R. Hibbard Jr., General Electric Co.

Thursday, Oct. 20—9:30 a.m.

Stainless Steels

Influence of Alloying Elements on the Impact Transition Behavior of 12% Cr Steels Aged at 900° F—E. J. Whittenberger and E. R. Rosenow, U. S. Steel Corp.

Creep Rupture Properties of Cold-Worked, Type 347 Stainless Steel—N. J. Grant, A. G. Bucklin and Warren Rowland, Massachusetts Institute of Technology.

Notch Ductility of Type 410 (12% Cr) Stainless Steel—F. A. Brandt, H. F. Bishop and W. S. Pellini, Naval Research Laboratory.

The Influence of Strain Rate and Temperature on the Ductility of Austenitic Stainless Steel—G. W. Form and W. M. Baldwin Jr., Case Institute of Technology.

Thursday, Oct. 20—2 p.m.

Stainless Steels

High Nitrogen Austenitic Cr-Mn Steels—V. F. Zackay, Scientific Laboratory, Ford Motor Co.; J. L. Carlson, Hoskins Mfg. Co. and P. L. Jackson, Misco Precision Casting Co.

The Effect of Composition and Structure on the Creep Rupture Properties of 18-8 Stainless Steels—F. C. Monkman, P. E. Price and N. J. Grant, Massachusetts Institute of Technology.

Austenitic Fe-Cr-C-N Stainless Steels—G. F. Tisinai, J. K. Stanley and C. H. Samans, Engineering Research Dept., Standard Oil Co. (Indiana).

Effects of Chemical Composition and Heat Treatment Upon the Microstructure and Corrosion Resistance of AISI Types 309 and 310—D. J. Carney and E. R. Rosenow, U. S. Steel Corp.

LECTURE ON EMBRITTLEMENT PHENOMENA

By B. R. Quenteau, Chief Metallurgist, U. S. Steel Corp.

Tuesday, Oct. 18—4:30 p.m.

Summary of Embrittlement Phe-

Squirrel cage motors, slip ring motors, synchronous motors, repulsion induction motors, capacitor motors, direct current motors . . . open, enclosed, splash-proof, fan-cooled, explosion-proof . . . horizontal or vertical . . . for all phases, voltages and frequencies . . . in single speed, multi-speed and variable speed types . . . with or without flanges or other special features . . . with 5 types of gear reduction up to 432 to 1 ratio . . . with electric brakes . . . with mechanical and electronically-controlled variable speed units . . . with fluid drives . . . and for every type of mounting . . . Master has them all and so can be completely impartial in helping you select the one best motor drive for YOU.

And all of these, the electric motors . . . the electric brakes . . . the fluid drives . . . the gear reduction units . . . the variable speed drives . . . all are designed so they can be easily combined together to give you the RIGHT horsepower, the RIGHT shaft speed, the RIGHT mounting features in one compact power drive.

That's the horsesense way to use horsepower whether you want 1/8 horsepower or 400 horsepower.

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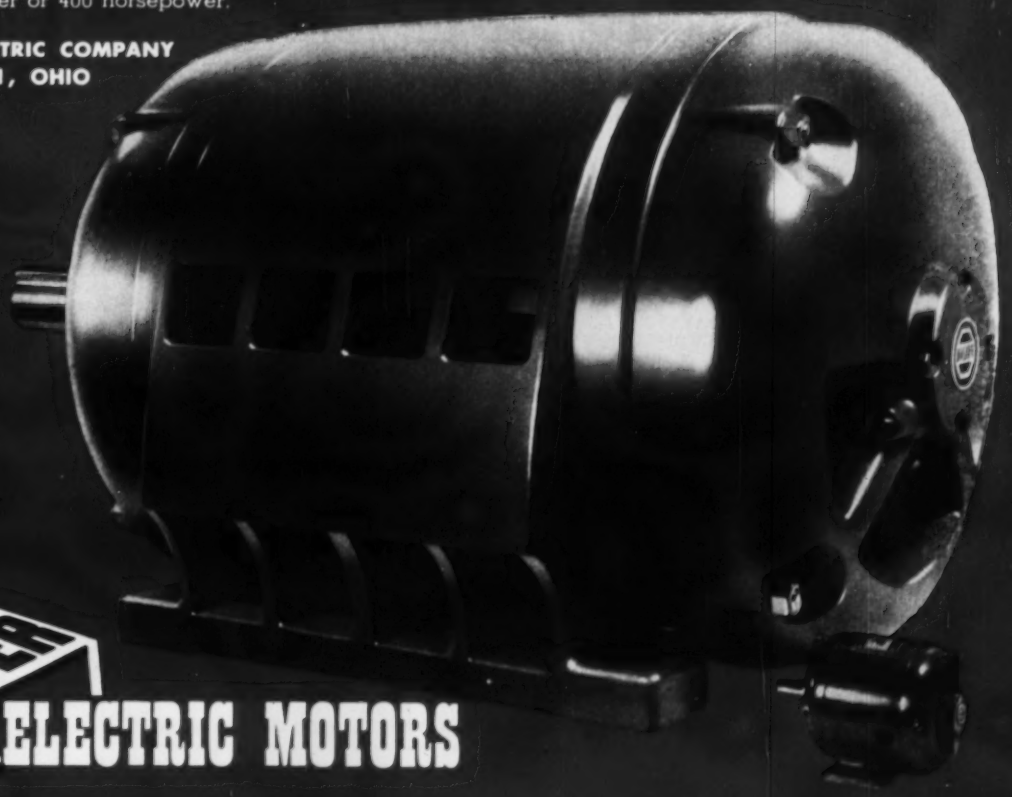
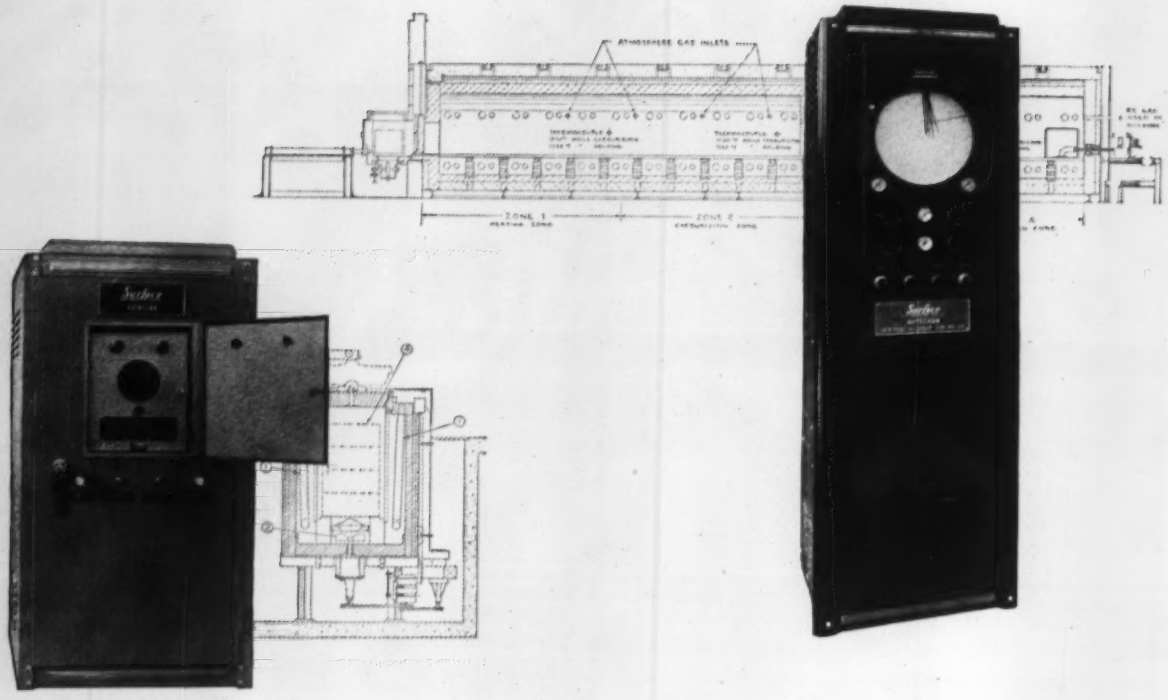
1/8 TO 400
HORSEPOWER



MASTER
ELECTRIC MOTORS

See these Autocarb units in operation at the Metal Show . . . visit the 'Surface' Booth No. 304



now Autocarb* for any budget and application

Automatic carbon potential control is now available at low cost with the addition of the new signalling Autocarb controller to the 'Surface' dewpoint control systems.

You can have economical, automatic dewpoint control for your batch-type furnace, a specific zone of your continuous atmosphere furnace, or your gas atmosphere generator. Apply it to carburizing, clean hardening, annealing, and other processes.

Autocarb recorder-controllers provide up to six point control, and the new signalling Autocarb controller offers single point control for those applications where a permanent record is not required.

The Autocarb system minimizes human error in atmosphere control and reproduces any type of case curve. It gives you precise uniformity from piece to piece, automatically compensating for varying carbon demand by your work, and helps you meet tighter specifications.

write for Bulletin H55-13

Surface* HEAT TREATING EQUIPMENT

**Trademark of Surface Combustion Corporation*

SURFACE COMBUSTION CORPORATION, TOLEDO 1, OHIO
also makers of Janitrol automatic space heating and Kathabar humidity conditioning units

nomena and General Discussion of Their Effects.

Tuesday, Oct. 18—8 p.m.
Work Hardening and Precipitation Embrittlement.

Wednesday, Oct. 19—4:30 p.m.
Embrittlement by Gases.

Wednesday, Oct. 19—8 p.m.
Temper Brittleness and Sigma Phase.

The 10th ASM metallographic exhibit will be in Convention Hall during the metal show. Twelve classifications of photomicrographs are designated.

A grand prize will be presented for the best entry. Blue ribbons will be given for the best entry in each classification. Other winners will get honorable mentions. Prize-winning entries will be included in the ASM traveling exhibit, which starts early in 1956.

CONFERENCE ON DUCTILE CHROMIUM AND ITS HIGH ALLOYS

Sponsors: Office of Ordnance Research, U. S. Army; ASM

Monday, Oct. 17—10:30 a.m.

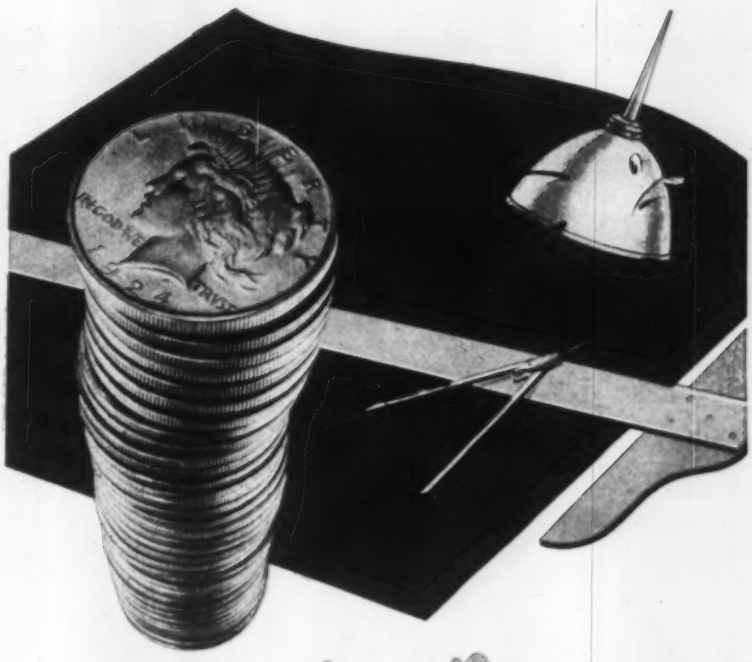
Worldwide Research on Ductile Chromium

Chairman—J. W. Dawson, Office of Ordnance Research, U. S. Army.
Introductory Remarks—Col. P. N. Gillon, Ordnance Dept., U. S. Army.
Research on Chromium in America—W. J. Kroll.
Research on Chromium in Australia—Henry L. Wain, Department of Supply, Australia.
Research on Chromium in Europe—A. H. Sully, Fulmer Research Institute, England.

Monday, Oct. 17—2 p.m.

Physical Metallurgy of High-Chromium Alloys

Chairman—J. H. Holloman, General Electric Research Laboratory.
Influence of Chromium Metal Purity on the Properties of Chromium Alloys—Robert I. Jaffee, Battelle Memorial Institute.
The Solubility of Nitrogen and Oxygen in Solid Chromium—A. A. Burr, Rensselaer Polytechnic Institute.
The Ternary System of Chromium-Nickel Alloy Containing up to 5% Nitrogen—N. J. Grant, Massachusetts Institute of Technology.



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Automatic Lubrication

You can profit many ways with Bijur Automatic Lubrication. Take a look at the machine tools in your plant . . . chances are they are equipped with Bijur! You are profiting by increased production capacity, reduced maintenance, less down-time, longer machine life and—most of all—by eliminating costly hand oiling.

Why not pass on to your customers these same advantages—build a Bijur system right into the machines you manufacture. You will profit again in goodwill and increased sales.

Bijur Automatic Lubrication is custom-engineered to your equipment. Customers will be assured trouble free service . . . every bearing receives the right amount of oil metered according to individual service requirements.

This dual benefit is just another reason why, for more than a quarter of a century, Bijur has been the accepted standard for automatic machine lubrication.

On the equipment you buy and on the equipment you sell, insist on the best . . . insist on Bijur.

Literature and engineering data are yours for the asking

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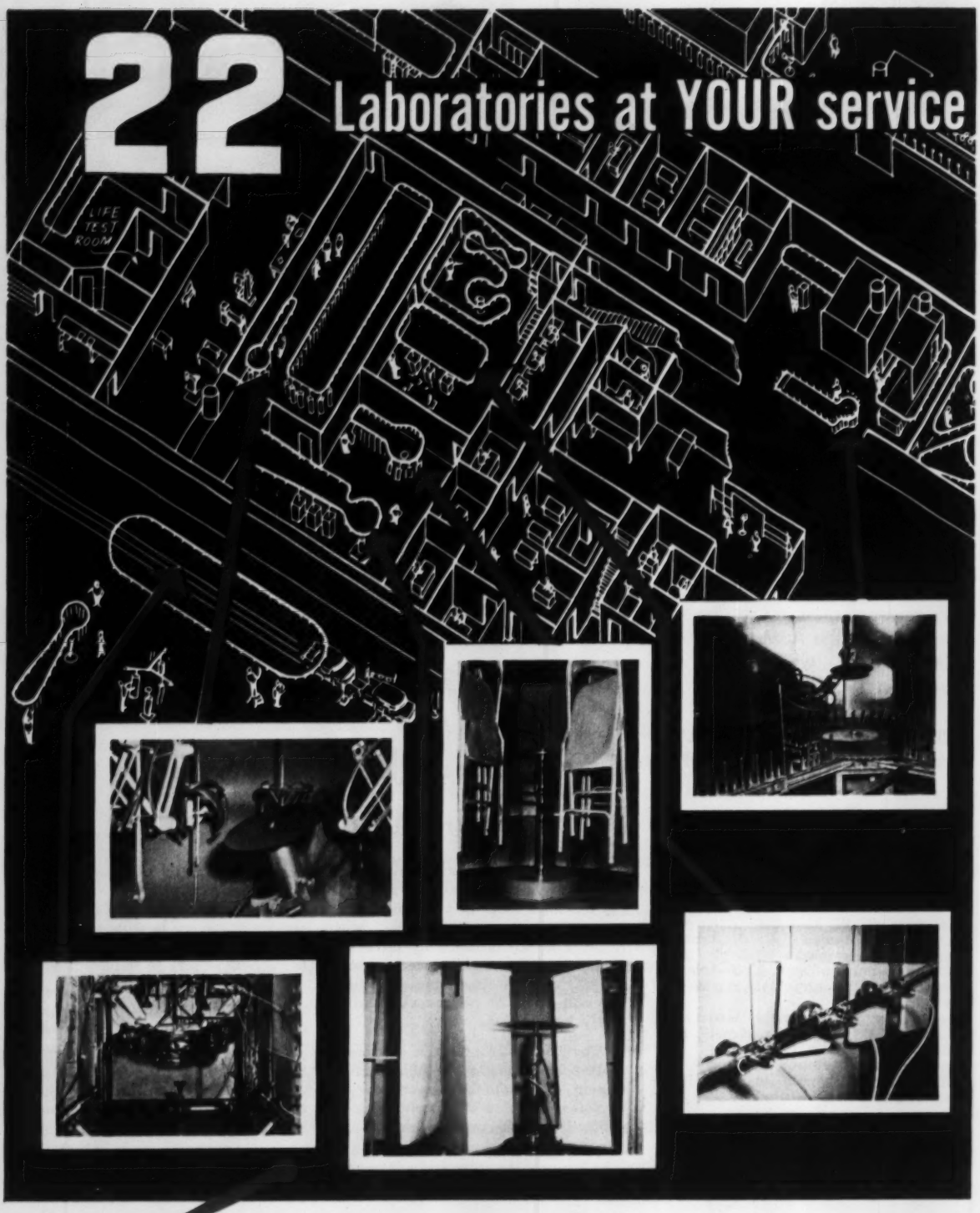

YOUR JOB, LIKE THESE SHOWN ABOVE, WILL BE TEST PROVEN

under simulated production conditions to determine cost-saving benefits and other advantages. Ransburg also maintains other test facilities in Los Angeles, London, England; Bad Hersfeld, Germany; Paris, France and Sydney, Australia.

to prove the painting of YOUR products with

RANSBURG

Electrostatic Painting Processes

Let us make laboratory tests and prove the advantages and cost-saving benefits of painting YOUR products AUTOMATICALLY with one of the Ransburg Electro-Spray Processes.

GET THE FACTS . . . IT COSTS YOU NOTHING!

STEP BY STEP—HERE'S WHAT YOU GET...

- Survey of your plant by Ransburg's experienced field engineers, including savings estimate.
- Lab painting demonstration of your products, using equipment closely simulating your own production conditions.
- Accurate measurements of paint film thickness.
- Engineering report of detailed tests to determine paint and labor savings.
- Coated samples of your job, lab production photos, and even movies if desired.
- Detailed drawings of equipment and workholder.

All of the above without obligation to you. And, before equipment is installed you receive detailed, pre-installation instructions. Too, a well-qualified, experienced engineer supervises installation and trains your operator on the job. Ransburg offers continuing laboratory and field service to help you with any of your finishing operations.

Ransburg

ELECTRO-COATING CORP.
Indianapolis 7, Indiana

● **First,** Ransburg sales engineers will make a survey in your plant to check the possibilities of using Electrostatic Spray Painting on your products. Next, you will send samples of your unpainted products—with paint—to the Ransburg laboratories in Indianapolis.

Here, the technical staff takes over. The Ransburg Engineering staff—which includes PH.D's and Masters in Physics, Science, Electrical, Mechanical and Chemical Engineering—makes a complete study of your job. Not only do they have the necessary academic training, but they have the "know how" gained from years of actual experience in the field. Ransburg, you know, was the pioneer in Electrostatic Spray Painting 15 years ago. Engineers and well-qualified technicians have at their disposal every facility for conducting complete tests, simulating your own production conditions. They'll decide which type conveyor is best suited for your job. (There's a conveyorized lab set-up—22 in all—to handle products ranging in size from automobile bodies and chassis to small components, such as window hardware.) They'll design workholders, if necessary, and determine exactly how your job can be run to your best advantage. Details, such as fixture spacing, will be worked out too.

After preliminary studies and tests, you are invited to Indianapolis to see your job run in the lab. If you wish, photos and even movies of your test run can be made and furnished for your own production people to study. You see first-hand what Ransburg Electrostatic Spray Painting can do for you in your own plant.

YOU GET PAINT AND LABOR SAVINGS

Paint usage is accurately measured during the demonstration. The Ransburg No. 2 Process will provide savings up to five times the paint mileage of hand spray. And, one unit can do the work of many hand sprayers. You will see the improved, uniform quality of the work . . . you'll know what kind of increased production to expect, and you can recognize labor savings. ALL OF THIS WITHOUT OBLIGATION.

Ransburg service doesn't end there. After the equipment is installed in your plant—with our supervisory help—we will train your operator and continue to work with your finishing department. Our technically-trained field service engineers are always available to assist with any of your finishing problems.

Briefly, that's our story. Now it's your move. Call or write.

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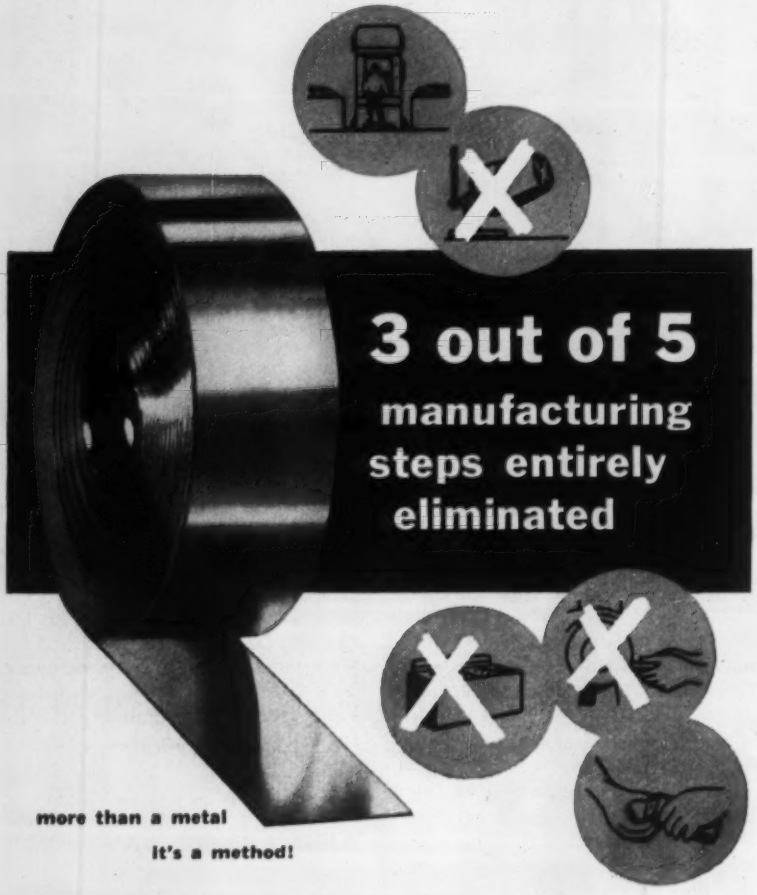
the Nickeloid Way



Even before they arrive at your plant, Nickeloid PRE-Plated Metals are 60% through your production process. No cleaning, plating or polishing . . . that's been done for you—expertly, uniformly, accurately. You just fabricate; then assemble. By-pass 3 out of 5 basic production steps. Reduce costs up to 20%; save time and lower investment in inventory and equipment.

Specify Nickeloid PRE-Plated Metals, in durable uniform finishes of chrome, nickel, copper or brass on base metals of steel, zinc, copper, brass or aluminum.

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ASM PROGRAM

Oxidation of Chromium and Chromium Alloys—W. Martin Fassel Jr., University of Utah.

The Kinetics of the Formation of the Sigma Phase in Chromium-Iron Alloys—Pol Duwez and Howard Martens, California Institute of Technology.

Tuesday, Oct. 18—9 a.m.

Chromium

Chairman—A. B. Kinzel, Union Carbide & Carbon Corp.

Preparation and Properties of Iodide Chromium—I. E. Campbell, Battelle Memorial Institute.

Electrowinning of Chromium from Trivalent Solutions—M. C. Carosella and J. D. Mettler, Electro Metallurgical Co.

Melting Point of High-Purity Chromium—LeRoy L. Wyman, National Bureau of Standards.

Mechanical Properties of Massive Chromium—G. Asai and K. D. Deardorf, U. S. Bureau of Mines.

Effects of Impurities on the Ductility of Chromium—W. H. Smith and A. U. Seybolt, General Electric Co.

Volume Change and Evolution of Gases on Heating Electrolytic Chromium—Kenneth A. Moon and George A. Consolazio, Watertown Arsenal.

Tuesday, Oct. 18—2 p.m.

High-Chromium Alloys

Chairman—P. R. Kosting, Watertown Arsenal Laboratories.

Ductile Chromium-Iron Alloys—R. W. Fountain and J. L. Lamont.

Toughness and Mechanical Properties of Chromium-Iron Alloys—H. Kato and E. T. Hayes, U. S. Bureau of Mines.

Creep Rupture Properties of Chromium-Nickel Alloys—N. J. Grant, Massachusetts Institute of Technology.

A Forgeable Chromium-Iron Based Alloy—D. P. Moon, H. A. Blank and A. M. Hall, Watertown Arsenal.

Metallography of Chromium and Chromium-Rich Alloys—W. D. Forgeng and G. T. Motock, Union Carbide & Carbon Research Laboratories.

POWDER METALLURGY IN ATOMIC ENERGY

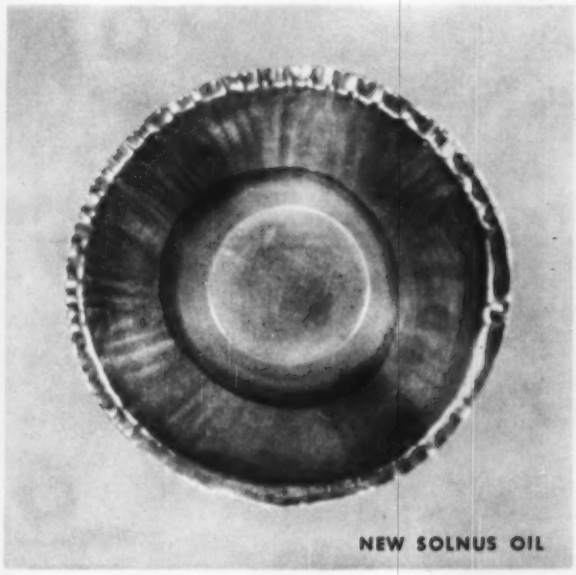
Sponsors: Office of Ordnance Research, U. S. Army; ASM
Chairman: Henry H. Sausner, Sylvania Electric Products Inc.

Thursday, Oct. 20—9:30 a.m.

General Metallurgical Problems in the Design of Nuclear Power Reactors—Vincent P. Calkins, General Electric Co.

Preparation of Metal Powders for Nuclear Reactor Purposes—Premo Chiotti and Harley A. Wilhelm, Iowa State College.

The Latest Developments in the



To demonstrate the comparative deposit-forming tendencies of compressor oils, two drops of a typical compressor oil were heated until evaporated. Notice the large deposit, *most of which is carbon*, left by the typical compressor oil. A new Solnus oil, after the same evaporation test, leaves a much smaller deposit.

NEW SOLNUS OILS HELP KEEP COMPRESSORS CARBON-FREE

THREE MINUTE TEST right at your desk shows why Solnus oils are the best for your compressors.

The chief enemy of air compressors is carbon build-up. The best way to avoid this hazard is to use the compressor oil that has the lowest carbon-forming tendency.

Sun's new Solnus oils have been proved to be ideal compressor lubricants. The minute amounts of carbon that form are fluffy and blow away easily . . . assurance against dangerous build-up of carbon on valves and exhaust ports. Tear-downs for cleaning are kept to a minimum.

We'd like to show you, right on your desk top, the dramatic test pictured above. Ask your Sun representative about it the next time he calls or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. SI.

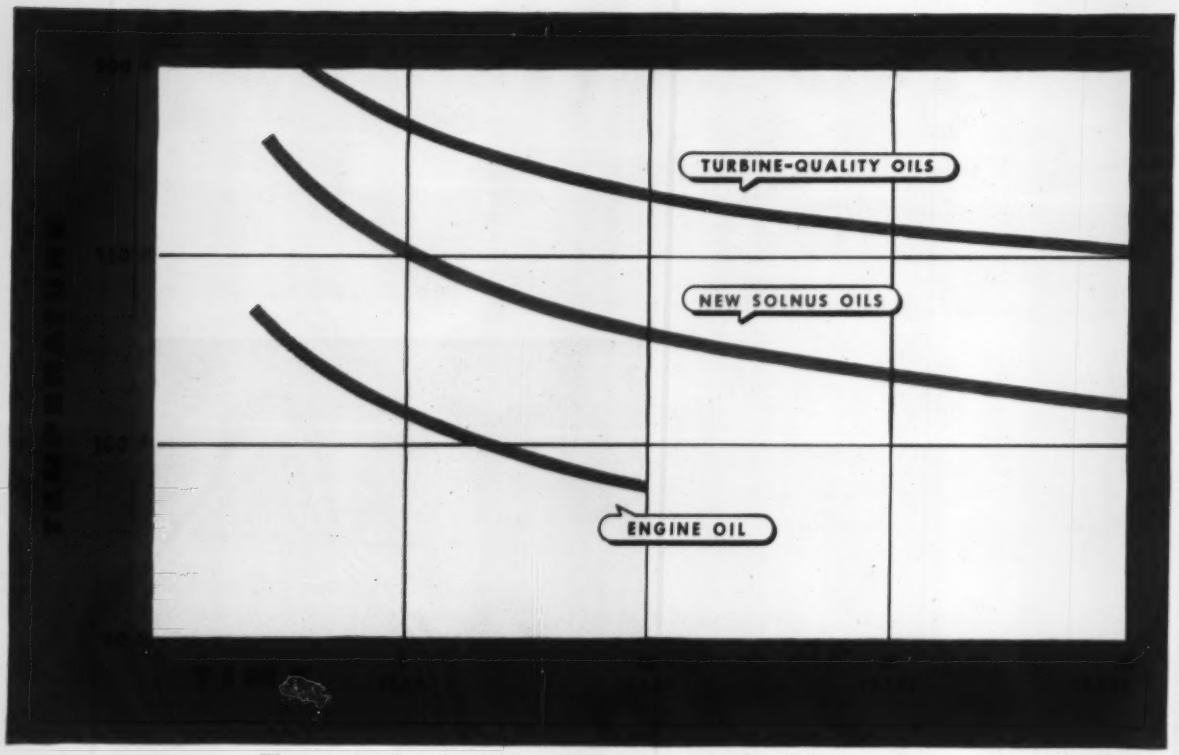
Please turn to the next page

SUNOCO

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY PHILADELPHIA 3, PA.

IN CANADA: SUN OIL COMPANY, LTD., TORONTO AND MONTREAL



This graph is based on 10% make-up per year and a 40-hour week.
The yellow area represents approximately 80% of all applications.

NEW SOLNUS OILS IDEAL LUBRICANTS FOR 80% OF ALL APPLICATIONS

High grade lubricants for squirt-can prices . . . New Solnus oils give more lubrication per dollar

The lubricated parts of most machines—our estimate is 80%—operate at temperatures below 130 F and the time between oil changes is less than 2 years. New Solnus oils were specifically developed to meet these operating conditions at the lowest possible cost.

The above graph compares the service life of new Solnus oils with that of an expensive, turbine-quality oil, and an oil of the type old-timers call "engine oil". The service life of the turbine-quality oil is excellent and probably covers 99% of all applications . . . but for a premium price! The engine oil has a very limited life. It cannot be used safely, except for a very short time, at even moderately high operating temperatures, and it gives very little protection against rust and corrosion.

Now look at the service life of new Solnus oils. They easily meet the service requirements of at least 80% of all oil lubrication jobs and they sell for a squirt-can price! In addition, new Solnus oils are fortified to prevent both rust and oxidation . . . a feature usually found only in more expensive oils.

For the full story on new Solnus oils, see your Sun representative or write Sun Oil Company, Philadelphia 3, Pa., Dept. SI.

SUNOCO

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

PHILADELPHIA 3, PA.

In Canada: Sun Oil Company, Ltd., Toronto and Montreal

ASM PROGRAM

Theory of Sintering—Leslie L. Seigle, Sylvania Electric Products Inc.

Thursday, Oct. 20—2 p.m.

The Powder Metallurgy of Beryllium and Zirconium—Harold Hirsch, General Electric Co.

Alloy Formation by Powder Metallurgy—Henry A. Saller and Frank A. Rough, Battelle Memorial Institute.

New Methods of Powder Metallurgy for Nuclear Reactor Purposes—William D. Manly, Oak Ridge National Laboratory.

Safe Handling of Pyrophoric and Radioactive Materials—L. R. Kelman, A. B. Shuck and R. C. Goertz, Argonne National Laboratory.

FALL MEETING, 1955

Metals Division, Special Libraries Association

Wednesday, Oct. 19—7 a.m.

All-day field trip to Bethlehem Steel Co. plants.

Wednesday, Oct. 19—8 p.m.
Sylvania hotel

Metals Division board meeting.

Thursday, Oct. 20—9:30 a.m.
Sylvania Hotel

Indexing Systems in Industrial Libraries

Use of the ASM-SLA System by Industrial Metallurgists—by E. C. Wallace, Barber-Colman Co.

Uniterm Coordinate Index System—Robert L. Francisco, General Electric Co.

Battelle Memorial Institute Subject Index System — Robert Gibson, Battelle Memorial Institute.

2 p.m. Powder Metallurgy

Powder Metallurgy Literature and the Library—Jean Haime, Fansteel Corp.

Powder Metallurgy with Especial Reference to the Refractory Metals—Harry W. Highriter, Vascoloy-Ramet Corp.

6:30 p.m. Dinner and social hour.

Joint meeting with Philadelphia Council of Special Libraries Association.

Friday, Oct. 21—

Morning—Field trip to American Society for Testing Materials.

Afternoon—Field trip to Franklin Institute.

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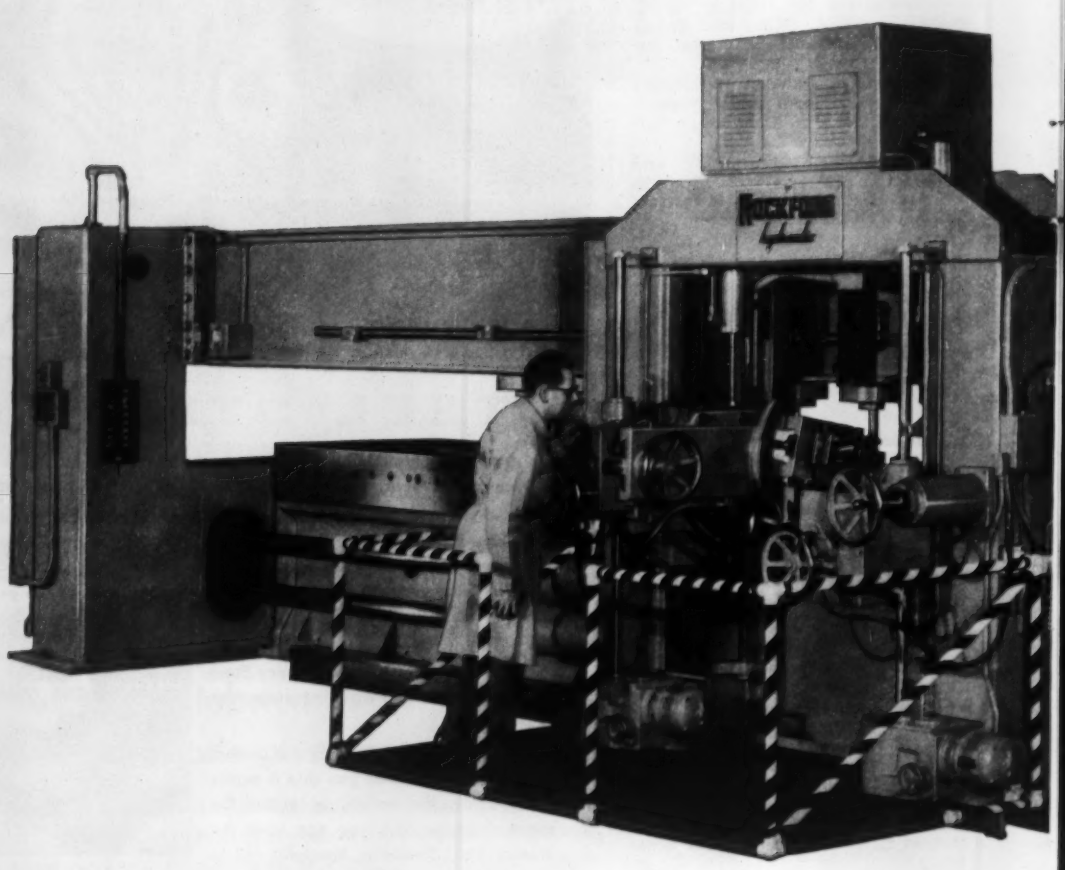
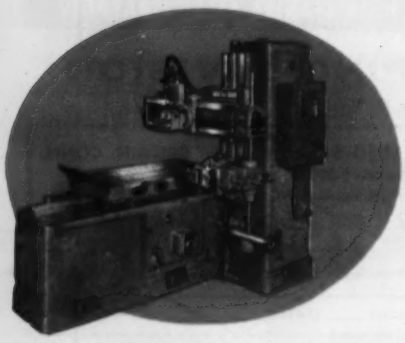
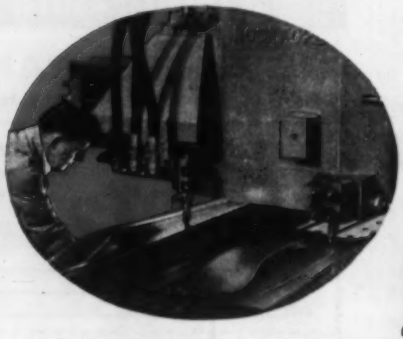


Hydraulic Openside Shaper



Hydraulic Kopy-Kat Duplicator



Hydraulic Shaper-Planer

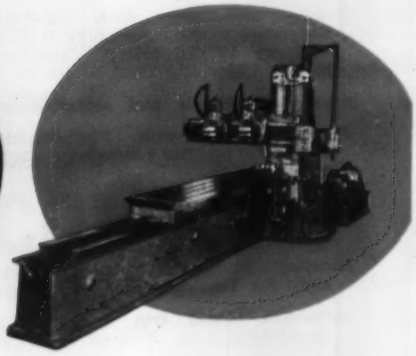
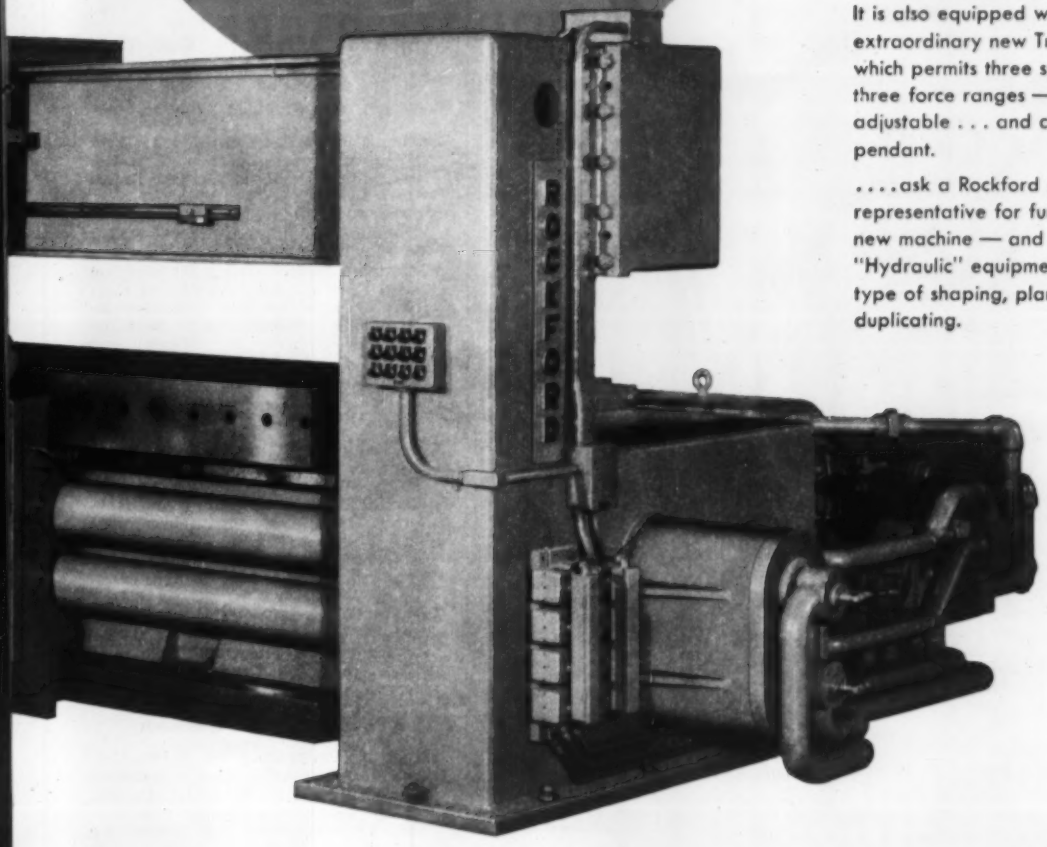


plate edge PLANER

with triple circuit!



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....it represents the first basic improvement in this type of machine in the past half century.

....the Hydraulic Plate Edge Planer has a working capacity up to 30' wide x 7 inches thick and its saddle reciprocates from 10 to 200 feet per minute. It is also equipped with the company's extraordinary new Triple Circuit . . . which permits three speed ranges and three force ranges — all infinitely adjustable . . . and controlled from the pendant.

....ask a Rockford Machine Tool Co. representative for further details on this new machine — and how modern "Hydraulic" equipment cuts costs on every type of shaping, planing, slotting and duplicating.

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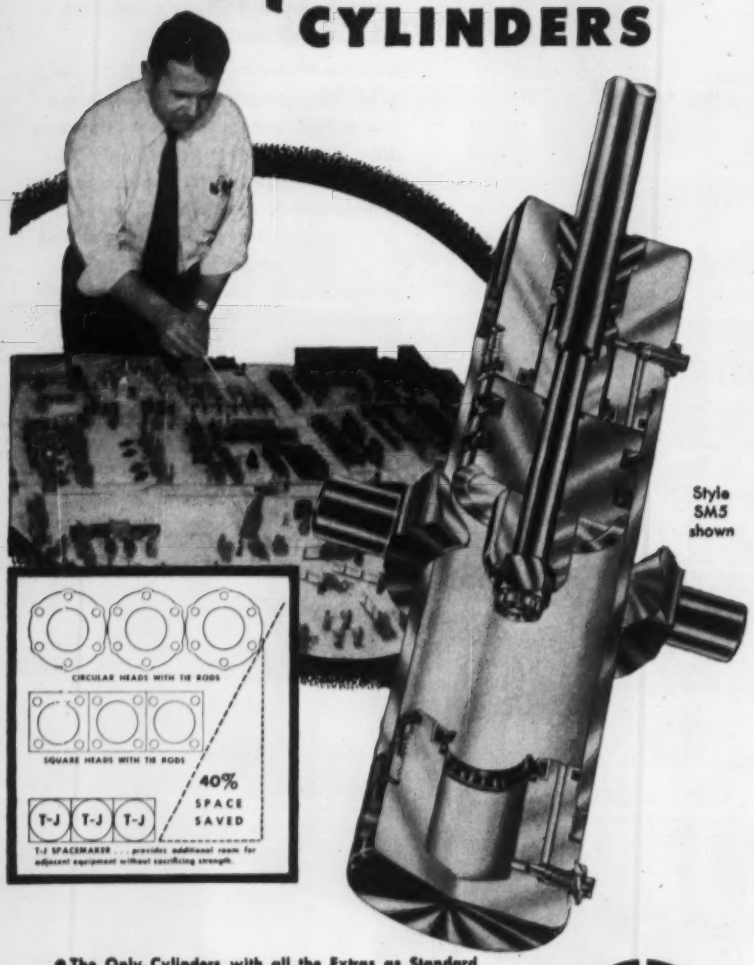
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Monday Afternoon, Oct. 17

Three Simultaneous Sessions

CO_2 Gas-Shielded Welding

Carbon-Dioxide Shielded-Metal Arc-Welding Process—Robert J. Keller and John P. Koss, A. O. Smith Corp.

Moisture and Its Effects in Carbon Dioxide Welding of Steel—Roger W. Tuthill, General Electric Co.

Electrode Characteristics for Welding Mild Steel in Atmospheres of Carbon Dioxide by the Consumable-Electrode Gas-Shielded Welding Process—Robert D. Mann and Julian D. Carey, General Electric Co.

Resistance Welding

The Behavior of Spot-Weld Cross Section During Loading—John F. Rudy, Wright Air Development Center, Roy B. McCauley and Robert S. Green, Ohio State University.

Seam Welding Dissimilar Thickness of Low-Carbon Steel—M. L. Begeman and Ernest J. Funk, University of Texas.

Resistance Spot-Welding Schedules for Welding Projection Hardware to Mild Steel Sheet and Plate—O. K. Barnes, Westinghouse Electric Corp.

Weldability and Research

Effect of Preheating on Stress-Corrosion Cracking of Steel Weldments—E. Paul DeGarmo and I. Cornet, University of California.

Heat Treatment of Air Hardening Alloys on Welding—John J. B. Rutherford and John F. Ewing, Babcock & Wilcox Co.

The Development of High-Tensile High-Impact Electrodes — G. S. Wepfer, A. O. Smith Corp.

Tuesday Morning, Oct. 18

Three Simultaneous Sessions

Weldability and Research

Further Studies of the Hot Ductility of High-Temperature Alloys—Ernest F. Nippes and Warren F. Savage, Rensselaer Polytechnic Institute.

Influence of Lattice Structure Upon Strength Ductility - Temperature Relationships — Julius Heuschkel,

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Tough Sprayed Metal

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maintenance method
now profitable
production process

equipment fabricators find tough, high-quality sprayed metals build big bonus pay-offs

Modern metallizing—metal spraying—which for many years has saved millions of maintenance dollars by restoring worn machine parts for thousands of companies, is now helping many others improve their products, cut production costs.

In the production of new equipment, tough sprayed metal coatings provide highly desirable mechanical or electrical characteristics at low cost, in high speed, semi-automatic production.

General Electric, for example, a long-time user of metallizing to provide superior wearing qualities on critical areas of large turbine shafting, now applies sprayed metals to a wide range of its products. Many forward-looking companies have instituted investigative programs in their research and design labs to explore the use of metallizing as a means of giving their products competitive advantages in quality, or performance or price—or all three.

Metallizing may be able to help your company improve its products, economically, reduce machine maintenance costs, cut your bills for corrosion protection. It may pay you well to look into it. In any event you will find it a fascinating subject. Bulletin 51 illustrates and describes "Metallizing—its practical applications"—shows actual work being done in users' shops. We shall be happy to send you a copy.

For engineering data see opposite page.

METCO

Metallizing Engineering Co., Inc.
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In Great Britain: Telephone: EDGEWOOD 4-1300
METALLIZING EQUIPMENT COMPANY, LTD.—Chobham near Woking, England

AWS PROGRAM

Westinghouse Electric Corp.

A Welding Test for Gray and Nodular Cast Iron—A. L. Schaeffler and W. A. Schumbacker, Allis-Chalmers Mfg. Co.

Structures

Fatigue Strength of Welds in Low-Alloy Structural Steels—G. E. Nordmark, W. H. Munse, J. E. Stallmeyer and N. M. Newmark, University of Illinois.

Welding of Structural Steel for Hartford Library—Carl L. Kreidler, Lehigh Structural Steel Co.

Fabrication of Crosshead Beams for the World's Largest Hydraulic Press—V. M. Nigriny, Midvale Co.

Inspection and Testing

Backing Ring Elimination Permits Ultrasonic Testing and Avoids Cracking of Piping Welds—Wilfred A. Pollock, Wisconsin Electric Power Co.

The Gamma Radiographic Control of Welded Transmission Pipe Lines—Colin M. C. Bates, Welding Supervision Ltd.

Radiography in the Jungles of Sumatra, Indonesia—Walter W. Offner, X-ray Engineering Co.

Tuesday Afternoon, Oct. 18

Three Simultaneous Sessions

Weldability and Research

The Effect of Microstructure on Notch Toughness and Fracture Morphology: Part II—Joseph C. Danko, John H. Gross and Robert D. Stout, Lehigh University.

Crack Arresting by Overlays of Notch Tough Weld Metal—P. P. Puzak and W. S. Pellini, Naval Research Laboratory.

Final Report on Brittle Fracture Studies—M. S. Northup and F. J. Feely Jr., Esso Research & Engineering Co.

Shipbuilding

Offshore Drilling Barges—Robert H. Macy, Ingalls Shipbuilding Corp.

Building an All-Welded 96-ft Twin-Screw Yacht—LaMotte Grover, Air Reduction Co., and E. H. Holder, Ingalls Shipbuilding Corp.

Stress Studies of Various Shaped Welded Doublers in Hatch Corner—Yoshio Akita, Transportation Technical Research Institute of Japan, H. Kihara, University of Tokyo, N. Ando, Transport Technical Research Institute, and K. Yoshimoto, Ishikawajima Heavy Industry Co.

Welding Equipment

Characteristics of a Rectifier Type Constant Voltage Power Supply—Jesse W. Pomazal, Harnischfeger Corp.

Transient Problems When Using Hypersil Transformers in Welding Applications—Robert C. Mierendorf, Square D Co.

Power Sources for Inert-Gas-Shielded Consumable Electrode Welding—A. Lesnewich and Everett Cushman, Air Reduction Co.

AWS PROGRAM

Wednesday Morning, Oct. 19

Three Simultaneous Sessions

Stainless Steels

Mechanical Properties of Modified Type 347 Weld Deposits—Lorin K. Poole and R. David Thomas Jr., Arcos Corp.

Hot Cracking of Stainless Steel Weldments—P. P. Puzak and W. S. Pellini, Naval Research Laboratory.

Permeability and Crack Sensitivity of Stainless Welds—John L. Lang and Charles Wright Jr., Lukens Steel Co.

Welding Electrodes

Metal Powder Electrodes and Their Applications—E. DiLiberti, Air Reduction Sales Co.

Properties and Applications of Low-Hydrogen Iron Powder Electrodes—D. C. Smith, W. G. Rinehart and D. C. Helton, Harnischfeger Corp.

Effect of Individual Coating Ingredients on Surface Tension of Iron Electrodes—Thomas H. Hazlett and Earl R. Parker, University of California.

Applications

Selection of Proper Inert-Gas Shielded-Arc Welding Process—J. Warden Cunningham and Harry A. Huff Jr., Air Reduction Sales Co.

High-Speed Welding of Steel Compressor Cases—C. F. Stephenson, York Grantly Division of York Corp., and Robert A. Stone, Air Reduction Sales Co.

New Surfacing Techniques—K. H. Koopman and R. S. Zuchowski, Linde Air Products Co.

Wednesday Afternoon, Oct. 19

Three Simultaneous Sessions

Titanium and Molybdenum

Welding of Titanium—E. F. Gorman, Linde Air Products Co.

Resistance Welding Ductile Joints in Commercially Pure Titanium—Robert Wickham, Marquardt Aircraft Co.

Effects of Oxygen on Soundness and Ductility of Molybdenum Welds—W. N. Platte, Westinghouse Electric Corp.

Welding Electrodes

A New Approach to Welding of Alloy Steels with Alloy Fluxes—Emmett Smith and Paul Jerabek, Lincoln Electric Co.

Effect of Aluminum Additions to Mild Steel Weld Metal—Craig R. Sibley, Air Reduction Co.

Effect of Current and Atmospheres on Arc Temperatures—George M. Gordon, Olga A. Cotter and Earl R. Parker, University of California.

Pressure Vessels

Performance of High-Strength Pressure Vessel Steels—J. H. Gross and R. D. Stout, Lehigh University.

Resistance of Low-Alloy Steel Plates, to Biaxial Fatigue—C. E. Bowman and T. J. Dolan, University of Illinois.

here's engineering data on *Sprayed Metals* in electrical and electronic equipment

Metallized zinc provides low-cost, efficient shielding for components of Dictaphone dictating machines.

Metallized copper on ceramic base resistors permits soldering of pigtails. Photo courtesy Friez Instrument Division, Bendix Aviation Corp.

1/4" of sprayed lead on this cast aluminum x-ray housing protects operator from radiation. Any thickness can be applied. Photo courtesy Metal Spraying Corp., Milwaukee, Wis.

Modern metallizing—sprayed metal—has found many applications in the production of electrical and electronic equipment. Originally metallizing was used to provide a soldering base on non-metallic materials in components such as resistors, capacitors and meter faces. Today, its use has spread to applications in shielding, the production of other types of electrically reflective surfaces and in the replacement of wired circuits.

FREE

We have prepared a bulletin which illustrates and describes a wide range of these applications. It also provides engineering data on bond strength on metallic and non-metallic materials, conductivity characteristics, permissible coating thicknesses, circuit tests, as well as a description of surface preparation and spraying methods. A copy of Bulletin 120 "Sprayed Metal Coatings," will be sent on request without charge.

METCO

Metallizing Engineering Co., Inc.

Westbury, L. I., N. Y. • Great Britain: Chobham near Woking

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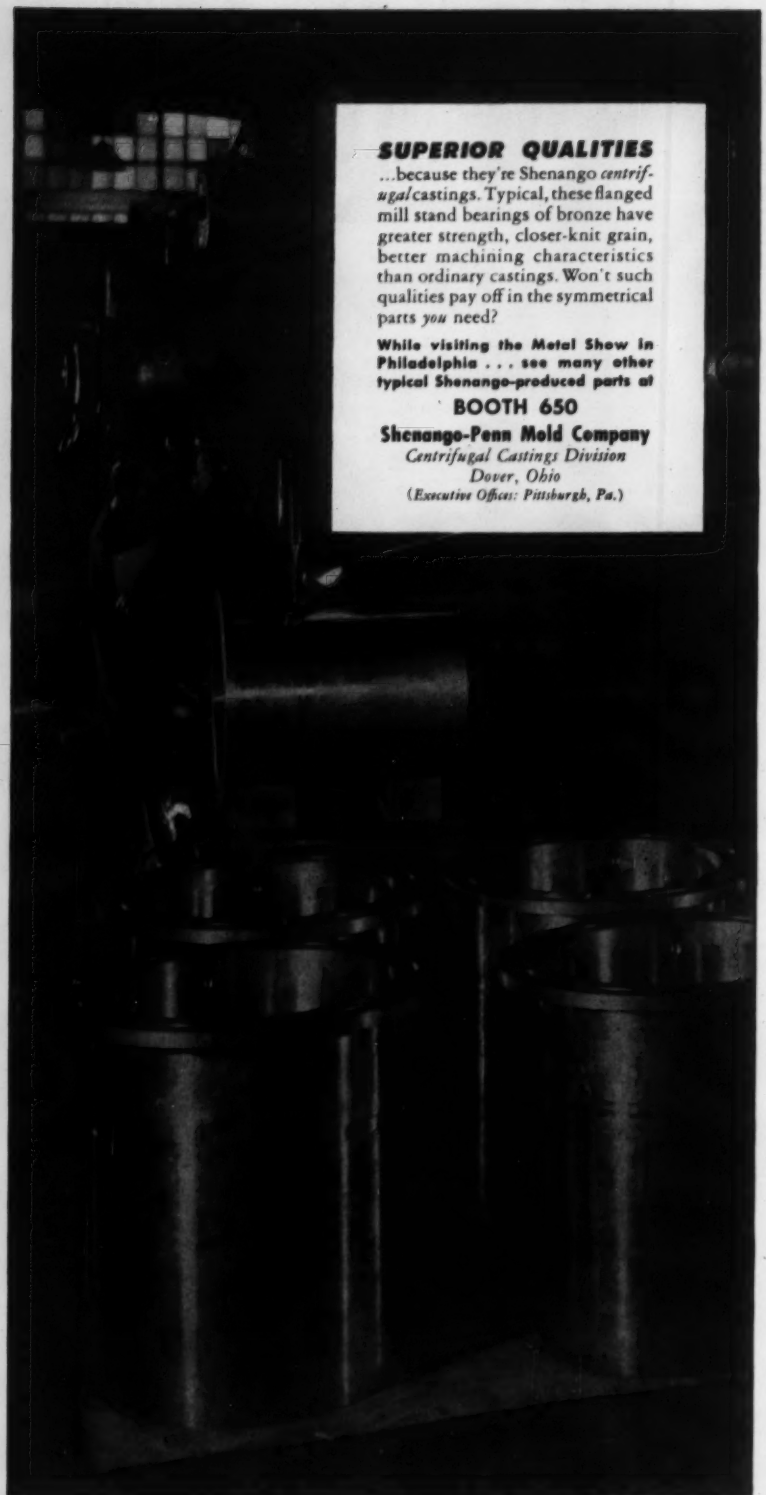
SUPERIOR QUALITIES
...because they're Shenango centrifugal castings. Typical, these flanged mill stand bearings of bronze have greater strength, closer-knit grain, better machining characteristics than ordinary castings. Won't such qualities pay off in the symmetrical parts you need?
While visiting the Metal Show in Philadelphia . . . see many other typical Shenango-produced parts at
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Shenango-Penn Mold Company
Centrifugal Castings Division
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CENTRIFUGAL CASTINGS
COPPER, TIN, LEAD, ZINC BRONZES · MONEL METAL
ALUMINUM AND MANGANESE BRONZES · NI-RESIST · MEEHANITE METAL

AWS PROGRAM

The Practical Approach to the Welding of Stainless Steel Pressure Vessels—Frederick H. Clash Jr., Link-Belt Co.

Thursday Morning, Oct. 20

Three Simultaneous Sessions

Aluminum

Inert Shielding Gases for Welding Aluminum — James D. Dowd, Aluminum Co. of America.

Hydrogen Vs. Acetylene Vs. Inert Gas in Welding Aluminum Alloys—J. Koziarski, Piasecki Helicopter Corp.

Welding Aluminum to Copper Using Inert-Gas Metal-Arc Process—L. A. Cook and M. F. Stavish, Kaiser Aluminum & Chemical Corp.

Piping and Pressure Vessels

Welding of High-Temperature High-Pressure Piping with Chrome-Moly Electrodes—Lloyd C. Nesbitt, Metal & Thermit Corp.

The Application of Inert-Gas Tungsten-Arc Welding to Carbon Steel Pipe—F. J. Pilia and R. W. Minga, Linde Air Products Co.

Welding Pressure Vessels with Automatic Submerged Arc—Wilmer W. Weber, Pfaudler Co.

Applications

Automation of Metal Manufacturing Requires Correct Use of Arc Welding—H. O. Klinke, Taylor-Winfield Corp.

How To Apply Automatic Submerged Arc Welding—Robert Wilson, Lincoln Electric Co.

Lower Part Cost by Projection Welding—C. H. Burgston, Deere & Co.

Friday Morning, Oct. 21

Three Simultaneous Sessions

Brazing

Wettability of Steel with Pure Silver and Silver Brazing Alloys—Nikolajs Bredzs, Armour Research Foundation.

Physical Properties of Butt Joints Brazed with BCu, BAg-1, and BAg-3 Filler Metals—Grant Hansel Jr., Materials & Processes Laboratory, General Electric Co.

Automatic Blade of High Solidity Axial Flow Fans—John B. Hill Jr., Sawyer-Bailey Corp.

Maintenance and Cutting

Effective Welding Circuit Maintenance—Donald L. Caldwell, Caterpillar Tractor Co.

Contour Beveling with the Electronic Tracer—Howard B. Cary, Marion Power Shovel Co., and R. F. Helmkamp, Air Reduction Sales Co.

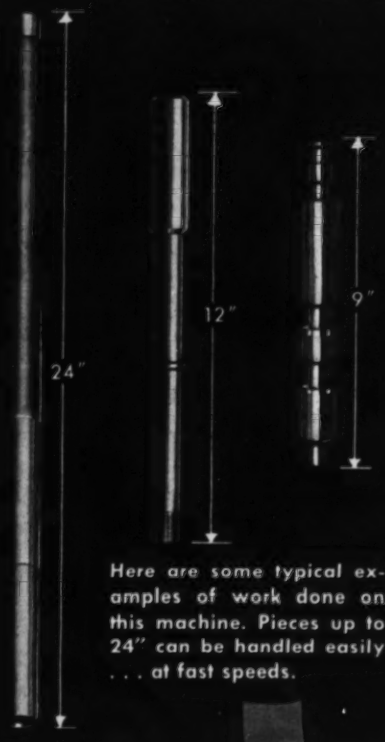
Applications

How To Use Steel Effectively in Machinery — Omer Blodgett, Lincoln Electric Co.

An Application of the Pressure Welding Process to Fabricate Continuous Rail—D. C. Hastings, Richmond, Fredericksburg and Potomac Railroad.

Manual Arc Welding of Butt Joints in Crane Rails—Ivan Kutuchief, A. O. Smith Corp.

impossible to machine long parts AUTOMATICALLY on your present equipment?



Here are some typical examples of work done on this machine. Pieces up to 24" can be handled easily . . . at fast speeds.

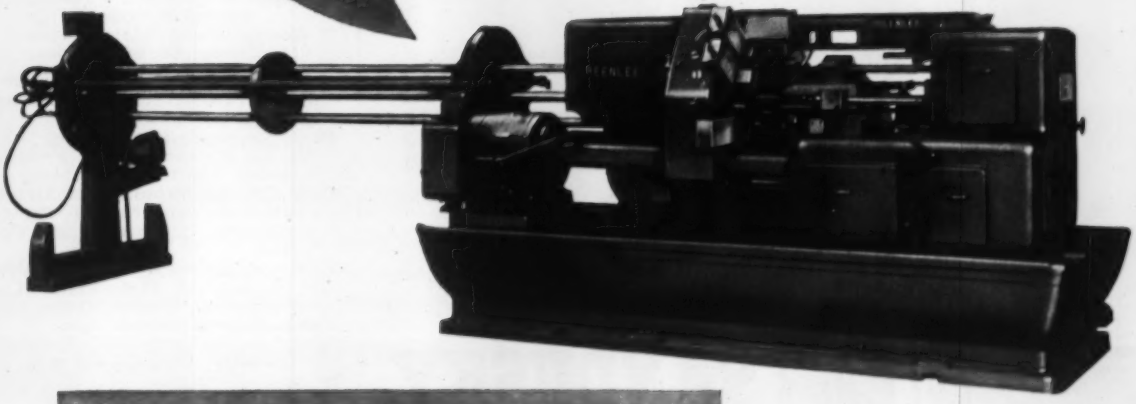
IT'S EASY...IT'S ECONOMICAL

with a GREENLEE SIX-SPINDLE BAR

AIR-FEED AUTOMATIC

This machine puts you in an enviable competitive position. Production goes up . . . costs go down. Check its many advantages: (1) Feeds out stock to 24" (2) Has multiple feed-out (3) Eliminates stock scoring (4) Reduces stock reel noise (5) Eliminates stock pushers and feed-out cams. Especially worth noting is the fact that the stock can be fed out in one or more positions during either the index cycle or feed cycle.

Additional data will gladly be sent on request. Write today.



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WRITE FOR COMPLETE INFORMATION

THE ANSWERS THROUGH RESEARCH

CHIEF SANDUSKY

FERROUS AND NON-FERROUS CENTRIFUGALLY CAST ROLLS, SLEEVES, TUBES, LINERS, CHUTES, RETORTS, RINGS, BUSHINGS, BEARINGS, ETC.

Sandusky Foundry technicians and engineers are constantly developing means of producing better ferrous and non-ferrous centrifugal castings. Experienced production personnel, the latest in product control, extensive field testing and laboratory research assure close grained, sound castings of maximum strength, added to extreme resistance to heat, corrosion, and abrasion.

Excellent machining facilities for drilling, turning and boring are available.

Look to Sandusky as an organization of specialists with the answers to your problems with the finest of centrifugal castings. ALWAYS SPECIFY CHIEF SANDUSKY.

C. M. Lovsted & Co., Seattle, Wash. • Tynes Bros., Birmingham Ala. • Cordes Bros., San Francisco and Wilmington, Calif.

Chief SANDUSKY CENTRIFUGAL CASTINGS

FERROUS AND NON-FERROUS

SANDUSKY FOUNDRY AND MACHINE CO., Sandusky, Ohio

Society for Nondestructive Testing

William C. Hitt
President

Hotel Sylvania

Monday, Oct. 17

Educational Survey

Chairman—Samuel A. Wenk, Battelle Memorial Institute.
Co-chairman—Frank Catlin—Magnaflux Corp.

9 a.m. Orientation Lecture — Dr. Robert C. McMaster, Ohio State University.
9:45 a.m. Sources of Defects Located by Nondestructive Testing—Carl E. Betz, Magnaflux Corp.
10:30 a.m. Radiography—Royal G. Tobey, Eastman Kodak Co.
11:15 a.m. Magnetic Particle Inspection—W. E. Thomas, Magnaflux Corp.
1:30 p.m. Penetrant and Eddy Current Testing—Hamilton Migel, Magnaflux Corp.
2:15 p.m. Ultrasonic Inspection—
Reflection Testing — John C. Smak, Sperry Products Inc.
Resonance Testing — Peter K. Bloch, Branson Instrument Co.
Immersion Testing—J. B. Morgan, Aluminum Co. of America.
3:30 p.m. Evaluation of Indications of Discontinuities—James H. Bly, X-Ray Inc.
4:15 p.m.—Question period

Tuesday, Oct. 18—9 a.m.

Production Testing

Chairman—Richard F. Holste, General Electric Co.
Co-chairman—Charles Tucker, Aluminum Co. of America.

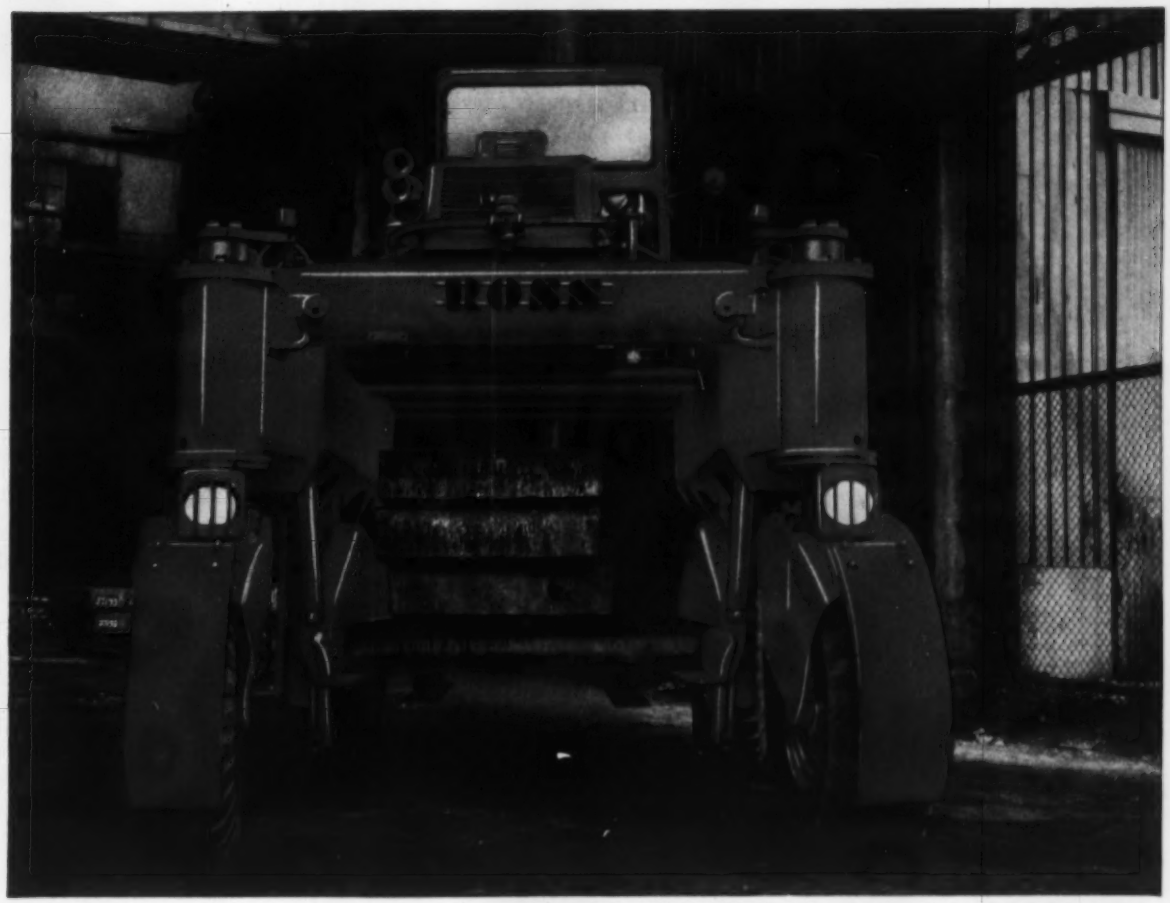
A High-Powered Industrial Fluoroscopic Tube—Donald T. O'Connor, Machlett Laboratories Inc.
Three Electronic Measurement Methods for Metallurgy—Dr. Friedrich Foerster, Reutlingen, Germany.
Eddy Current Inspection in Aircraft Production Applications—Richard Hochschild, University of California.
Field and Laboratory Stress Analysis of Locomotive Components—Ludvig Petersen, Electro-Motive Division, General Motors Corp.

Tuesday, Oct. 18—2 p.m.

Aircraft Inspection

Chairman—John E. Rutledge, McDonnell Aircraft Corp.
Co-chairman—Roderic E. Kleint, North American Aviation.

Management Looks at Nondestructive Testing in Commercial Aircraft Manufacture—Paul Allen, Beech Aircraft.



Delivering semi-finished steel to outside storage by Ross Carrier—Kaiser Steel Corp., Fontana Works, Fontana, California.

Here's production flow ingenuity...

Kaiser Steel's 1 2 3 Operation!

1 A foreman calls for material over a two-way radio.

2 Immediately a Ross Carrier rushes into action . . . locates the material.

3 Loaded in seconds, the Ross Carrier is on its way to delivery.

No hold-up of production flow at Kaiser Steel. Blooms and slabs of semi-finished steel are rushed at a moment's notice to specialty mills for treatment. Four highly maneuverable Ross Carriers, equipped with two-way radio, have greatly reduced rail hauling within the plant site . . . have made operations between conditioning yards, storage yards and the mills, a fast, *modern* operation.

CLARK® EQUIPMENT

Industrial Truck Division CLARK EQUIPMENT COMPANY, Battle Creek 26, Michigan

FREE—a 16-page idea book! Gives you 21 industrial applications of the Ross Carrier—profitable ideas that you can use in your own business. Just tear out this coupon and attach to your letterhead. We'll rush you a copy with no obligation.

BERYLLIUM COMES OF AGE

New product development, integrated production facilities, new marketing techniques mark wide acceptance of beryllium copper alloys

ARC FURNACES make possible high production of master alloy, out of which other beryllium copper forms are made.

Twenty years ago beryllium copper was an experimental alloy. Today it is a production material in widespread demand, used for its unique combination of strength, conductivity, formability, and dozens of other valuable properties. It is used in production tools, such as giant flash welders; in consumer products, such as refrigerators and cars; in developments as up to date as nuclear energy.

The Beryllium Corporation, world's most integrated producer of beryllium copper, foresaw this demand and took steps to meet it.

New sources of beryl ore, raw material of the beryllium industry, were sought out—with such success that the Government now says resources are adequate for both civilian and defense needs.

New alloys were developed. "Beryldur," for example, is a new low-cost alloy offering a combination of strength and conductivity not hitherto available.

A multimillion-dollar plant expansion program made possible greater production, increased the range of sizes and shapes, tightened tolerance ranges.

At the same time, mill service was supplemented with conveniently located warehouse stocks of "Berylco" Beryllium Copper. Leading nonferrous distributors throughout the United States and Canada now stock "Berylco" in a wide range of sizes for immediate delivery.

Write today for sample material or engineering help.

QUALITY CONTROL FOR MASS PRODUCTION. This new direct-reading spectrometer analyzes beryllium alloys while they are still molten.

APPLICATIONS UNLIMITED. This 16-page booklet describes scores of typical applications for beryllium copper. Send for your free copy . . . today.

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SNT PROGRAM

The Relationship of Quality Control to Nondestructive Testing—Brig. Gen. William P. Farnsworth, Staff Director for Inspection and Quality Control, office assistant secretary of defense.

The Application of Nondestructive Testing by a Manufacturer of Military Aircraft—W. J. Maloney, Fairchild Aircraft Co.

Application of Nondestructive Testing in the Manufacture of Aviation Gas Turbine Engines—Fred W. Rhode, Westinghouse Electric Corp.

Wednesday, Oct. 19—9 a.m.

Marine Inspection

Chairman—Martin B. Graham, Boston Naval Shipyard.
Co-chairman—Frank L. Johnson, Bethlehem Ship Building Co.

Radiography of Marine Equipment—Willard L. Schwinn and Gilbert R. Forrer, Babcock & Wilcox Co.

Ultrasonic Testing of Ship Plate—Howard E. Dickerman, Portsmouth Naval Shipyard.

Nondestructive Testing in Naval Construction—William P. Kelley, Bath Iron Works.

Radiography of Welds Using Portable X-Ray Equipment—G. W. Beverett Jr., Long Beach Naval Shipyard.

Nondestructive Testing in Construction of Aircraft Carrier *Saratoga*—John L. Cahill, New York Naval Shipyard.

Wednesday, Oct. 19—2 p.m.

Annual Meeting

Chairman—William C. Hitt, National President SNT

Report on Brussels Meeting—Dr. Gerold H. Tenney, chairman, SNT International Relations Committee.

De Forest Award (to be announced)

Coolidge Award (to be announced)

Lester Honor Lecture

The Basis for Standards of Radiation Protection—Dr. Lauriston S. Taylor, Chief Atomic Radiation & Physics Division, National Bureau of Standards.

Annual Business Meeting

Thursday, Oct. 20—9 a.m.

Ordnance Inspection

Chairman—Carlton H. Hastings, Watertown Arsenal

Electromagnetic Radiation for Testing of Ordnance Products—Dr. Josephy I. Bujes, Naval Ordnance Test Station.

Nondestructive Test Engineering at Frankford Arsenal—Maurice J. Smith and Alfred J. Wysoczanski, Frankford Arsenal.

Production Radiographic Inspection of Propellants—Carl E. Johnson, Silas Mason Co., Cornhusker Ordnance Plant.

Characteristics of a Closed Link Television X-Ray Inspection System—Daniel Polansky and Edward L. Criscuolo, Naval Ordnance Laboratory.

Betatron Strobo-Radiography—R. A. Pulk, Detroit Arsenal.

Industrial PUSH-TYPE CRANES

ECONOMICALLY HANDLE HEAVY CASTINGS

Courtesy of DI MACHINE CORP., CHICAGO, Manufacturer of DIEBEL PUNCH PRESSES.

Hoisting a 300 lb. casting off the floor to a machine is done in a moment—easily and safely with an economical Industrial Crane.

You, too, perhaps could facilitate the machining of those heavy parts in your shop or speed loading of your trucks by using Industrial Push-Type Cranes.

Whenever efficient hoisting and handling of machines or objects is a problem, Industrial Cranes can provide an economical answer. Industrial Crane & Hoist Corporation builds quality cranes for every purpose, in models to suit different requirements, hand operated and motor driven in capacities up to 20 tons.

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Service problems are minimized in the A.B.C. automatic washer by use of Johnson sintered bronze Ledaloyl self-lubricating bearings.

Altorfer Brothers Company assures customer satisfaction by using Johnson Bearings in its A.B.C. Washers

One way that Altorfer Brothers Company, Peoria, Ill., manufacturer of the A.B.C. line of washers, ironers and driers, gets assurance of customer satisfaction is to install the finest bronze bearings available. Altorfer uses powdered bronze bearings made by Johnson Bronze Company of New Castle, Pa., because they are carefully produced to exact specifications and because they retain enough oil to service the bearings during the life of the washer.

Consider the Ledaloyl sintered bronze bearings which Johnson Bronze makes for use on the A.B.C.-O-Matic washer's shaft and tube. This bearing, one of eight sintered bronze bearings, is the workhorse of the washer and is vital to the operation of the shaft which spins the tub. Johnson Bronze Company has supplied these bearings to Altorfer Brothers since 1950 when the firm first began to make automatic washers.

Altorfer Brothers has used Johnson bearings for other applications since 1928 because of their uniform high quality.

If you have a tough application that calls for long bearing life under rugged conditions, you will want to learn how Johnson Bronze bearings can build more customer satisfaction into your product. If you need it, trained engineering help is available to guide you in choosing the bearings which will lower costs and improve performance. Johnson Bronze Company, 550 South Mill Street, New Castle, Pa.

Johnson Bearings

LEDALOYL *(powder metallurgy)* • BRONZE ON STEEL • ALUMINUM ON STEEL • CAST BRONZE • STEEL AND BABBITT

SNT PROGRAM

Thursday, Oct. 20—2 p.m.

Casting, Forging and Weld Inspection

Chairman—John Delisa,
General Electric Co.
Co-chairman—Clyde B. Jenni,
General Steel Castings Co.

Factors Affecting Interpretation of Ultrasonic Indications—Robert H. Hafemeister, Allis-Chalmers Mfg. Co.

Geometry Influence on Ultrasonic Testing of Large Forgings—Steve Serabian, General Electric Co.

Ultrasonic Testing of Rail and Railroad Equipment—Dr. Erich Martin, German Federal Railroad.

Nondestructive Testing of Lead Linings—Kempton H. Roll, Lead Industries Associates.

Nondestructive Testing of Electrical Forgings—F. Howard Oberlin and R. H. Leith, U. S. Steel Corp.

IHEA

Horace Drever
President

Industrial Heating Equipment Association

Main ballroom, Convention Hall

Tuesday, Oct. 18—2 p.m.

Chairman—Alfred E. Tarr, Leeds & Northrup Co.

Furnaces, Combustion Equipment and Induction Heating

Vacuum Melting by Induction and Arc—Frank Chesnut, Ajax Electrothermic Corp.

Batch-Type Strip Annealing Furnaces: Multiple and Single Stack—Floyd Olmstead, Lee Wilson Engineering Co.

Combustion and Its Control—Fred Bloom, Bloom Engineering Co.

Wednesday, Oct. 19—2 p.m.

Mechanized Heat Treating Equipment and Its Application—Metallurgical Aspects Associated with Induction Heating

Mechanized Molten Baths — Leon Rosseau, Ajax Electric Co.

Mechanized Batch-Type Furnaces—Martin Neumeyer, Sunbeam Corp.

Mechanized Continuous-Type Furnaces—George McCormick, Industrial Heating Equipment Co.

Metallurgical Aspects Associated with Induction Heating—Dr. Harry Osborn, Tocco Division, Ohio Crankshaft Co.

Directors' Meeting
...THE MORNING AFTER

In the middle of the night fire hit this plant with sudden, blasting fury. Started in oil storage and spread like lightning. Next morning the directors could rightfully ask, *"Where was our fire protection?"*

Unfortunately, it lay in a desk drawer—a proposal for a fire extinguishing system that would have made oil storage and half a dozen other equally bad hazards fire-safe. Procrastination pigeonholed protection . . . and disaster didn't wait!

In *most* plants there are critical hazards for which generalized fire protection may be hopelessly inadequate. It was for just such "hot spots" that CARDOX years ago originated "Low Pressure Carbon Dioxide Systems"*. Applying CARDOX CO_2 as readily in tons as in pounds, these Systems stop fires unbelievably fast . . . without any extinguishment damage whatsoever. They have saved industry many millions of dollars.

Why not ask CARDOX to survey and give you a report on *your* danger spots? There's no cost or obligation.

*Covered by Patents Issued & Pending

CARDOX
ORIGINATOR OF **Low Pressure CO_2**
FIRE EXTINGUISHING SYSTEMS

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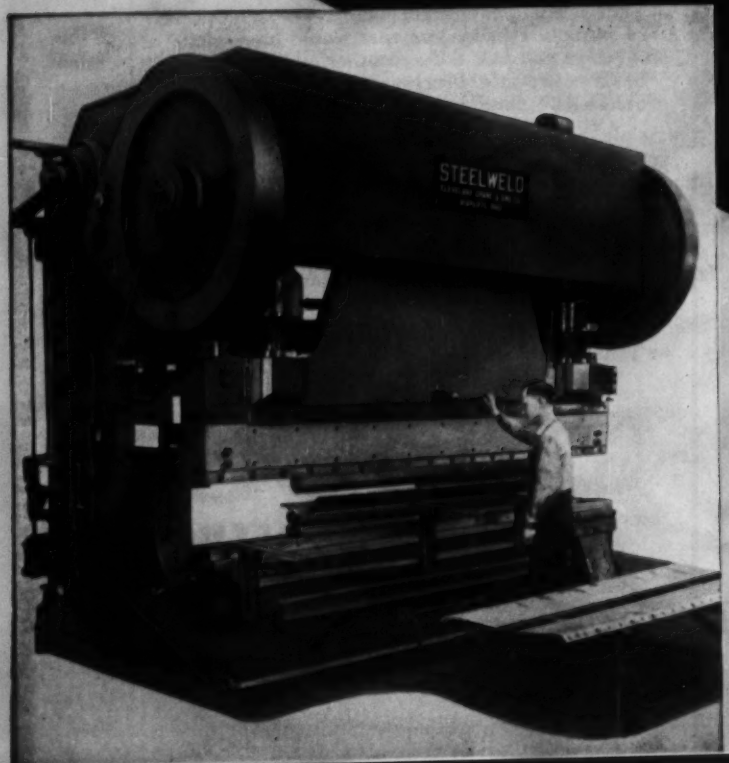
Offices in Principal Cities

Two-Point Straight-Side Press

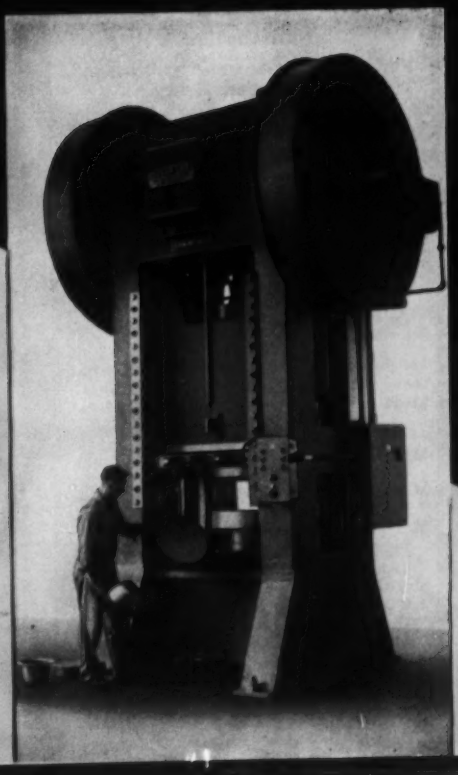
Single Point Twin Drive

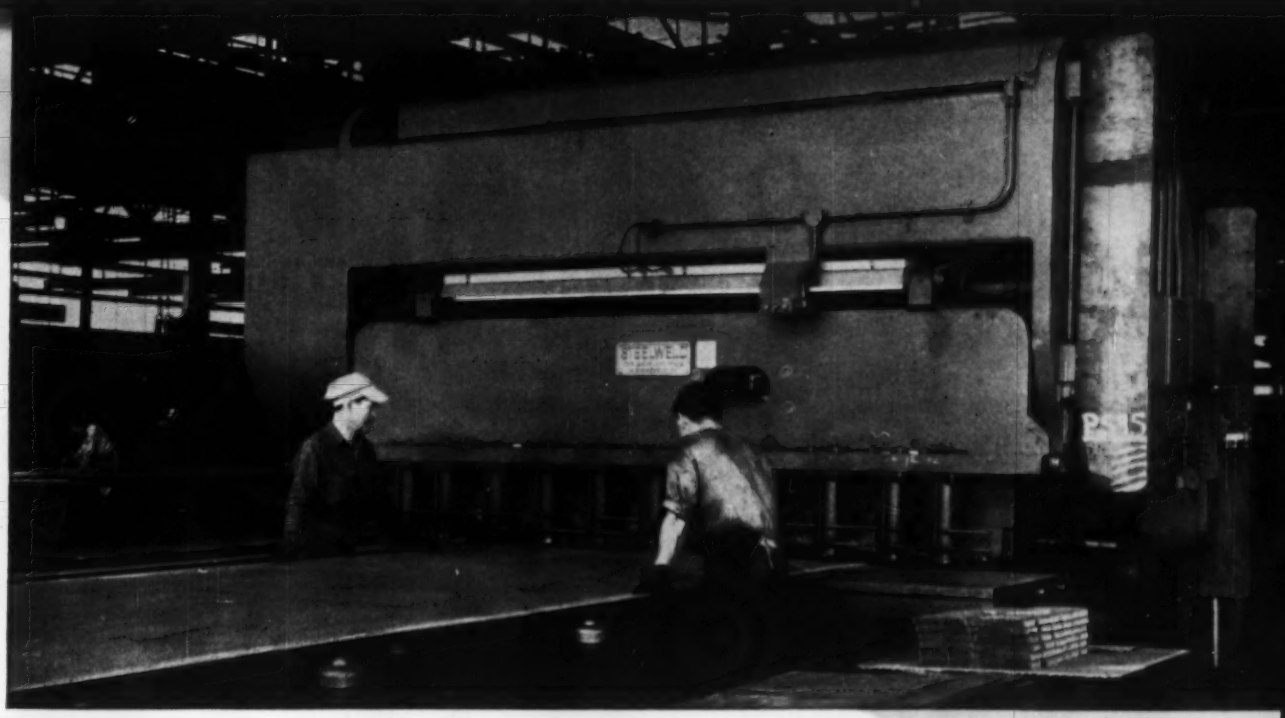
STEELWELD
PRESSES and SHEARS

Steelweld Bending Press



Single-Action Hi Draw





Pivoted-Blade Shear

A BROAD LINE of Steelweld Mechanical Presses and Shears is available to serve you. All machines are built for heavy duty, continuous operation. Latest features required for high-speed, mass-production runs are provided. Design is generous throughout for long life and low maintenance.

Steelweld forming presses range in size from 150 tons up. Bending presses and shears available for plate thicknesses to 1¼" and lengths to 24'-0".

Descriptive information giving details on any or all of the machines illustrated will be gladly sent upon request.

Representatives in all principal cities

THE CLEVELAND CRANE & ENGINEERING CO.

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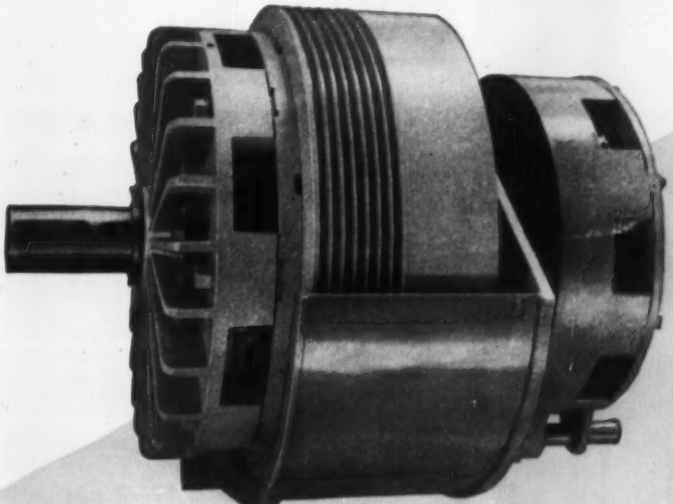
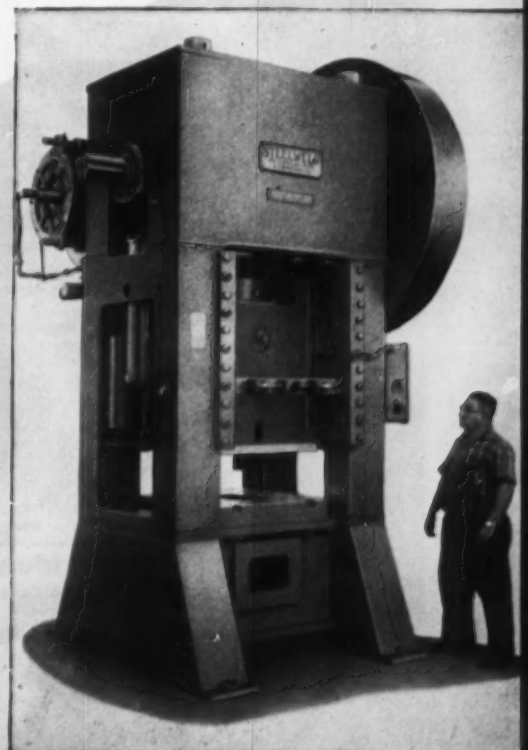
Single-Point Single-Drive



Outstanding UNITIZED Clutch and Brake

Steelweld's own air-operated design, with low inertia and fast heat dissipation, has been fully proven under rigorous conditions. Clutch, brake and flywheel are built together as a unit for quick, easy removal or replacement.



Binks Complete Line offers you
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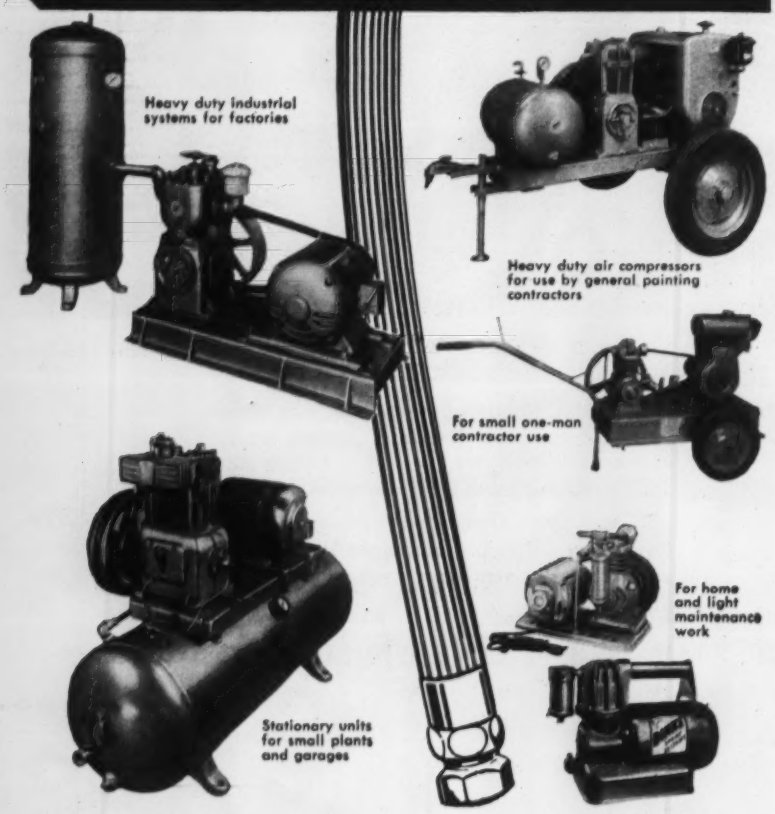
AIR COMPRESSOR
to meet your special needs

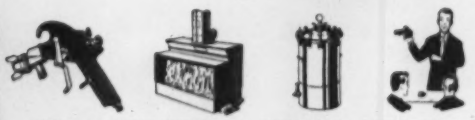

Heavy duty industrial systems for factories
Heavy duty air compressors for use by general painting contractors
For small one-man contractor use
For home and light maintenance work
Stationary units for small plants and garages

For each job there is an air compressor that is just right...one that gives you the volume and pressures you need with maximum flexibility and economy. The Binks Line of air compressors gives you a choice of 50 models from compact ¼ h.p. portable units to almost any size you need...each designed to do a specific job or to fit into a given air supply system. Before you buy or specify a new compressor, investigate the Binks Line...it will pay you!

To be sure you get the right compressor

Ask your distributor or write direct to us for copies of **HOW TO SELECT AN AIR COMPRESSOR** and **BINKS CATALOG 810.** They will tell you what to look for in an air compressor and show you available models, accessories, etc. No obligation.

Binks
EVERYTHING FOR SPRAY PAINTING



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Institute of Metals Division AIME

Henry DeWitt Smith
President

Adelphia hotel

Monday, Oct. 17—9 a.m.

Crystal Room

Research in Progress

Chairmen—Paul Gordon and B. S. Lement

Jefferson Room

Deformation (I)

Chairmen—Howard Scott and G. A. Timmons

Internal Friction in Zirconium—W. J. Bratina, Ontario Research Foundation, and W. C. Winegard, University of Toronto.

Creep of Polycrystalline Tin—J. E. Breen and J. Weertman, Naval Research Laboratory.

Interaction of Precipitation, Solid Solution Content and Creep in Magnesium-Aluminum Alloys—C. S. Roberts, Dow Chemical Co.

Tensile Deformation of Germanium Single Crystals—R. P. Carreker Jr., General Electric Co.

Tensile Deformation of Molybdenum as a Function of Temperature and Strain Rate—R. P. Carreker Jr. and R. W. Guard, General Electric Co.

Mechanism of Plastic Flow in Titanium at Low and High Temperatures—F. D. Rosi, RCA Laboratories, F. C. Perkins and L. L. Seigle, Sylvania Electric Products Inc.

Strain Rate Effects in Tungsten—J. H. Bechtold, Westinghouse Electric Corp.

Effects of Oxygen, Nitrogen and Carbon on the Ductility of Cast Molybdenum—L. E. Olds and G. W. P. Rengstorff, Battelle Memorial Institute.

Strain-Induced Porosity and Hydrogen Embrittlement in Zirconium—F. Forscher, Westinghouse Electric Corp.

Monday, Oct. 17—2 p.m.

Jefferson Room

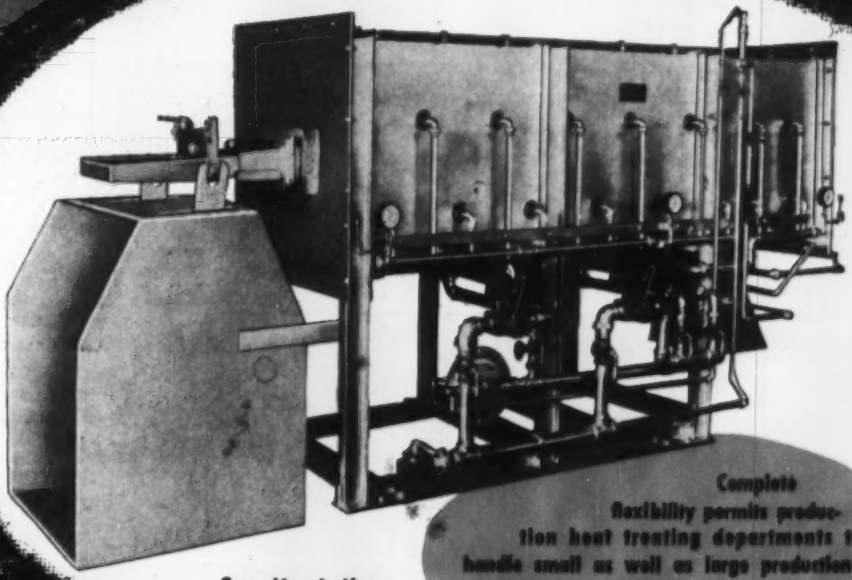
Seminar on Recrystallization and Grain Growth

Chairmen—Bruce Chalmers and J. E. Burke

New RECIPROCATING HEARTH FURNACE

Patent 2,671,654

by AGF Pioneers, the originators and builders of Reciprocating Furnaces since 1921. Features include stationary muffle and complete atmosphere control.



Complete flexibility permits production heat treating departments to handle small as well as large production lots on a continuous basis.

See it at the
METAL SHOW
BOOTH NO. 1914

Carburizing, case hardening, Ni-Carb process of ammonia-gas carburizing, clean hardening, etc. of parts ranging from balls for ball point pens to heavy forgings can be accomplished with ease in the same model without any modification.

Newly engineered fully automatic feeding device is now available to eliminate costly work handling in charging the furnace.

Individualized treatment assures uniformity of product. Each piece is individually heated, subjected to the atmosphere and quenched. Disadvantages of batch heating and quenching are eliminated. Work can be observed throughout the processing cycle.

Only the work enters and leaves the heating chamber. Baskets, trays, chains and other troublesome mechanisms are completely eliminated.

Sizes in production capacities up to 600 pounds per hour.

Representatives in principal cities.

AMERICAN GAS FURNACE CO.
ELIZABETH 4, N. J.
LAFAYETTE STREET

Send your Bulletin 850 which will help us produce a quality product at lowest cost.

NAME.....TITLE.....

COMPANY.....

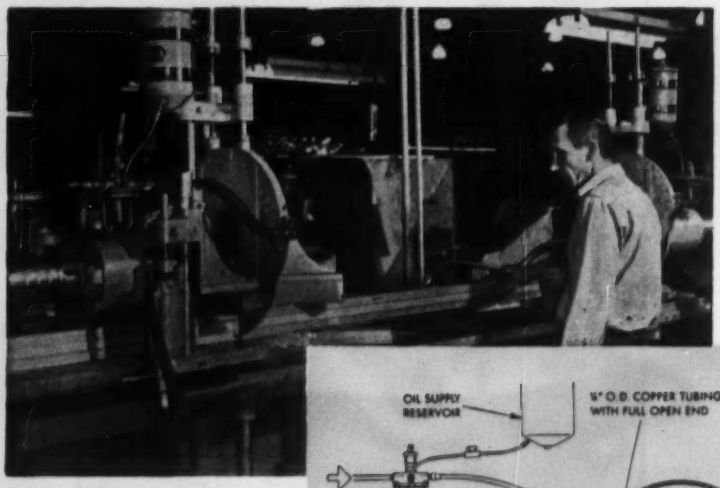
ADDRESS.....

NORGREN Oil-Fog Lubrication
increases saw blade life 20 times
AT ALUMATIC CORPORATION of AMERICA

This prominent manufacturer of aluminum storm doors and windows uses Norgren Oil-Fog Lubrication on 16" circular saws for cutting to length extruded aluminum bars and shapes. The extrusions are 2½" to 4" wide and are generally stacked 3" to 4" high for simultaneous cutting.

Saw blade life expectancy was approximately 8 hours with the previous manual lubrication system, and burrs at the cut ends were excessive. With Norgren Oil-Fog Lubrication for each saw blade, the blade life has been increased to 3 to 5 weeks. A manual operation has been eliminated. Smoother cuts are obtained, burrs practically eliminated.

The Alumatic Corporation uses Norgren lubricators exclusively for the lubrication of pneumatically operated equipment.



A ¼" Norgren lubricator is used to lubricate each saw blade. The lubricant is a specially compounded cutting oil used at the rate of 3 fluid ounces per hour per blade. A cam-actuated spring loaded valve permits continuous spray application for heavy cuts and intermittent application on light cuts.

For complete details on this Norgren Oil-Fog application, write for Norgren Blueprint No. 122, or phone the Norgren representative listed in your telephone directory, classified section under Norgren Pneumatic Products.

C. A. Norgren CO.
3412 So. Elati, Englewood, Colo.

AIME PROGRAM

Temperature Dependence of Annealing Phenomena in a Cold-Rolled Aluminum Single Crystal—A. H. Lutts and P. A. Beck, University of Illinois.

Recrystallization Textures of a Cold-Rolled Aluminum Single Crystal—Y. C. Liu, New York University, and W. R. Hibbard, Jr., General Electric Co.

Primary Recrystallization Textures in Cold-Rolled Silicon-Iron Crystals—C. G. Dunn and P. K. Koh, General Electric Co.

Preferred Orientations in Rolled and Annealed Titanium—J. H. Keeler and A. H. Geisler, General Electric Co.

Measurement of Grain Growth Rates in Recrystallization—C. D. Graham Jr., General Electric Co., and R. W. Cahn, University of Birmingham, England.

Grain Growth Rates and Orientation Relationships in the Recrystallization of Aluminum Single Crystals—C. D. Graham Jr., General Electric Co., and R. W. Cahn, University of Birmingham, England.

Crystal Room

Symposium on Nuclear Metallurgy

Chairman—J. H. Frye Jr.

Asst. chairmen—D. H. Gurinsky and A. R. Kaufmann

Plutonium Metal—E. R. Jette, Los Alamos Scientific Laboratory.

Physical Metallurgy of Thorium—H. A. Wilhelm and B. A. Rogers, Iowa State College.

Physical Metallurgy of Uranium—F. G. Foote, Argonne National Laboratory.

Monday, Oct. 17—8 p.m.

Crystal Room

Symposium on Nuclear Metallurgy

Chairman—J. H. Frye Jr.
Asst. Chairmen—D. H. Gurinsky and A. R. Kaufmann

Power Reactors—A. M. Weinberg, Oak Ridge National Laboratory.

Problems in Materials for Atomic Power—J. B. Howe, North American Aviation Inc.

Tuesday, Oct. 18—9 a.m.

Jefferson Room

Seminar on Deformation (II)

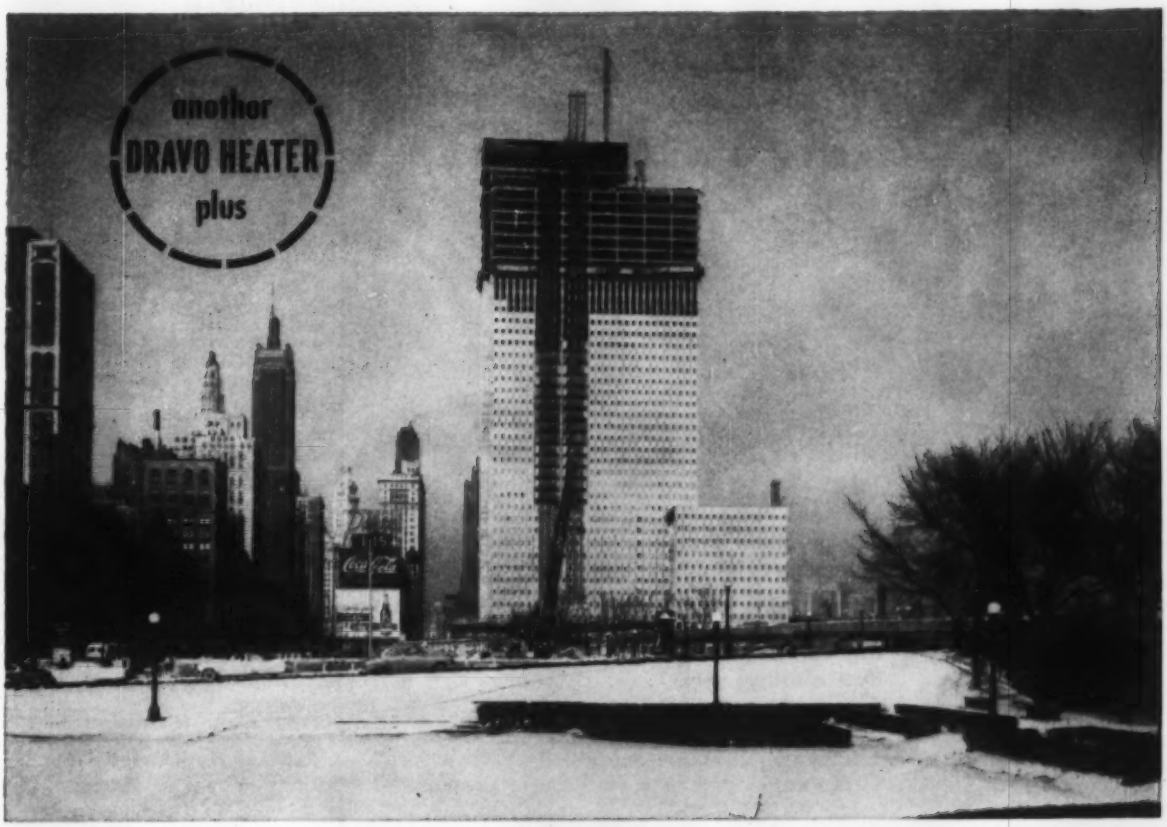
Chairmen—Robert Maddin and F. L. Vogel Jr.

Effects of Alloying Elements on Plastic Deformation in Aluminum Single Crystals—E. E. Underwood and L. L. Marsh, Battelle Memorial Institute.

Tensile Creep of High Purity Aluminum—R. W. Guard and W. R. Hibbard Jr., General Electric Co.

Creep of Copper at Intermediate Temperatures—T. E. Tietz and J. E. Dorn, University of California.

Creep-Rupture by Vacancy Condensation—E. S. Machlin, Columbia University.



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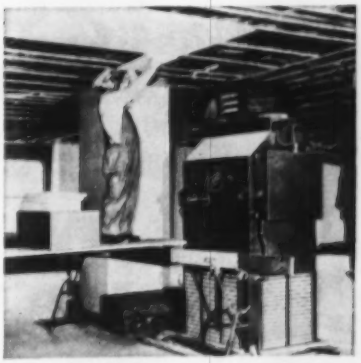

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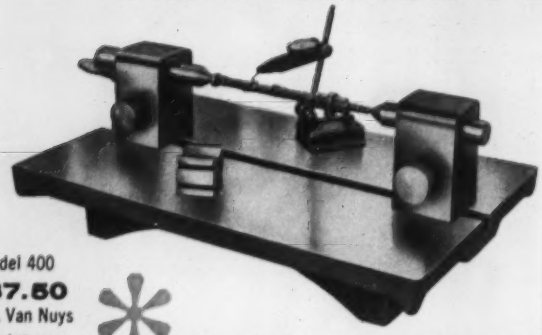

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Washington Steel
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WASHINGTON PENNSYLVANIA

AIME PROGRAM

Cleavage Steps on Zinc Monocrystals: Their Origins and Patterns—J. J. Gilman, General Electric Co.
On the Collapse of Dislocation Loops During Annealing—Jack Washburn, University of California.

Symposium on Titanium

Chairman—L. Shapiro
Asst. chairmen—J. H. Jackson and L. S. Busch

Keynote address — Dr. Herbert H. Kellogg, chairman of Titanium Advisory Committee, Office of Defense Mobilization.
Present Status of Titanium Development—D. J. McPherson, Armour Research Foundation.
Panelists:
S. A. Herres, Titanium Metals Corp.
L. S. Busch, Mallory-Sharon Titanium Corp.
V. W. Whitmer, Republic Steel Corp.
D. W. Kaufmann, Rem-Cru Titanium Corp.
Harold Margolin, New York University.
Status of Titanium Fabrication and Use (a report of the Department of Defense, Titanium Steering Committee)—J. H. Garrett, office assistant secretary of defense.
Panelists:
Lt. Col. L. W. Herway, U. S. Air Force.
J. J. Harwood, Office of Naval Research.
N. L. Reed, Watertown Arsenal.
C. B. Voldrich, Battelle Memorial Institute.

Tuesday, Oct. 18—2 p.m.

Crystal Room

Symposium on Titanium

Chairman—L. Shapiro
Asst. chairmen—J. H. Jackson and L. S. Busch

The Background for Practical Heat Treatment of Various Titanium Alloy Types—P. D. Frost, Battelle Memorial Institute.
Panelists:
W. L. Finlay, Rem-Cru Titanium Corp.
B. Morelander, North American Aviation.
S. Abkowitz, Watertown Arsenal.
William Rostoker, Armour Research Foundation.
H. J. Middendorp, Materials Laboratories, Wright-Patterson Air Force Base.
Future Use Pattern for Titanium—Colonel B. S. Mesick, Retired, Arthur D. Little Inc.
Panelists:
L. Shapiro, Douglas Aircraft Corp.
C. W. Alesh, Consolidated Vultee Aircraft Corp.
R. Thielemann, Pratt & Whitney Aircraft Corp.
V. Kudryk, Chemical Construction Co.

Jefferson Room

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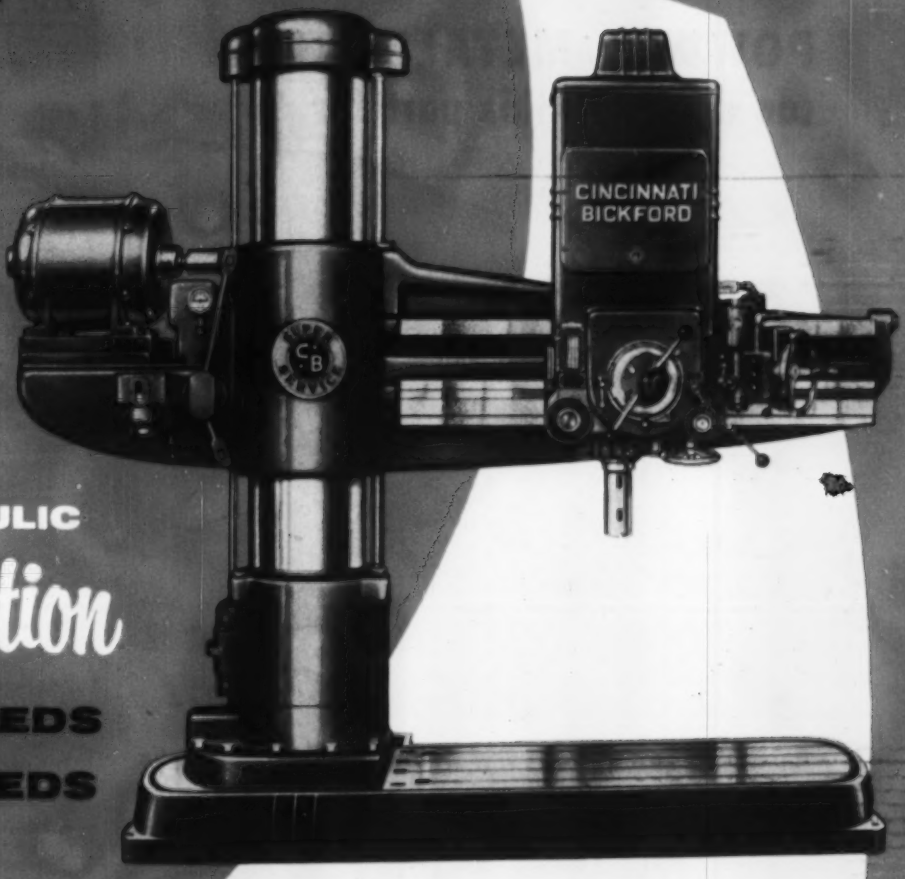

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Company.....
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AIME PROGRAM

Chairmen—C. E. Birchenall and A. S. Nowick

Diffusion of Nitrogen in Iron—P. E. Busby and Cyril Wells, Carnegie Institute of Technology, and D. P. Hart, Pittsburgh Plate Glass Co.

Diffusion in Liquid Lead—S. J. Rothman, Argonne National Laboratory, and L. D. Hall, Stamford Research Institute.

Self-Diffusion in Solid Nickel—R. E. Hoffman, F. W. Pikus and R. A. Ward, General Electric Co.

Diffusion and Marker Movements in Beta Brass—U. S. Landegren, SKF Industries Inc., C. E. Birchenall, Princeton University, and R. F. Mehl, Carnegie Institute of Technology.

Self-Diffusion in Single and Polycrystals of Zinc at Low Temperatures—F. E. Jaumot Jr. and R. L. Smith, Franklin Institute.

Some Studies of Al-Cu and Al-Zr Solid State Bonding — Samuel Storcheim, Sylvania Electric Products Inc. *Journal of Metals,* August, 1955

On the Rate of Sintering—Gerhard Bockstiegel, Sintermetallwerk Krebsoge Smett, Germany.

Temperature Gradient Zone Melting —W. G. Pfann, Bell Telephone Laboratories Inc. *Journal of Metals,* September, 1955

Thermodynamic Properties of Solid Iron-Gold Alloys—L. L. Seigle, Sylvania Electric Products Inc.

A Search for Oxidation-Resistant Alloys of Molybdenum—G. W. P. Rengstorff, Battelle Memorial Institute

Wednesday, Oct. 19—9 a.m.

Jefferson Room

Constitution and General Metallurgy

Chairmen—D. J. Blickwede and David Swan

Titanium-Rich Corner of the Ti-Al-V System—J. J. Rausch and F. A. Crossley, Armour Research Foundation, and H. D. Kessler, Titanium Metals Corp. of America.

Titanium-Molybdenum-Oxygen System—P. A. Farrar, L. P. Stone and Harold Margolin, New York University.

Thorium-Columbium and Thorium-Titanium Alloy Systems—O. N. Carlson, J. M. Dickerson, H. E. Lunt and H. A. Wilhelm, Iowa State College.

System Zirconium-Nitrogen — R. F. Domagala, D. J. McPherson and M. Hansen, Armour Research Foundation.

Fabrication of Powdered Thorium—W. W. Beaver, K. G. Wikle and J. G. Klein, Brush Beryllium Co.

Metallographic Identification of Nonmetallic Inclusions in Uranium—R. F. Dickerson, A. F. Gerds and D. A. Vaughan, Battelle Memorial Institute.

Crystal Room

Joint Symposium on High-Temperature Alloys

Here's how one manufacturer saves 20% on over-all manufacturing costs with SSW forged rings

By switching to Standard Steel forged steel rings a leading manufacturer of asphalt drying units saves 20% on over-all manufacturing costs. Used as rails on which 25-ft. long dryer drums rotate, these solid rings have replaced hot rolled steel bars which were formed into hoops and welded. It was found that these bars cracked under the severe load and pressure of the drums turning at 8 to 10 rpm.

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AIME PROGRAM

Institute of Metals Division of AIME and Metals Engineering Division of ASME

Chairmen—W. R. Hibbard Jr., Institute of Metals Division, AIME, and J. J. B. Rutherford, Metals Engineering Division, ASME

Materials for Use up to 1250° F

Alloy Design of Material up to 1250° F—J. W. Freeman, University of Michigan.

Stability of Alloy Steels—A. B. Wilder, National Tube Division, U. S. Steel Corp.

Some Practical Aspects of High-Temperature Design Below 1250° F—E. C. Chapman, Combustion Engineering Inc.

Wednesday, Oct. 19—2 p.m.

Crystal Room

Joint Symposium on High-Temperature Alloys (continued)

Materials for Use Above 1250° F

Principles of Design and Development of Alloys for Use Above 1250° F—N. J. Grant, Massachusetts Institute of Technology.

Some Practical Aspects of Design Above 1250° F—A. W. F. Green, General Motors Corp.

Jefferson Room

Phase Transformations

Chairmen—M. E. Nicholson and W. G. Pfann

High-Speed Quenching Dilatometer—F. E. Martin and R. H. Raring, Naval Research Laboratory.

Heat Treatment and Mechanical properties of Titanium-Iron Alloys—F. C. Holden, H. R. Ogden and R. I. Jaffee, Battelle Memorial Institute.

Effect of Carbon on Some Properties of Ti-Mo Alloys—D. W. Levinson, W. Rostoker and A. Yamamoto, Armour Research Foundation.

Hardenability of Titanium Alloys Calculated From Composition: A Preliminary Examination—L. D. Jaffe, California Institute of Technology.

Preliminary Examination of the Quenching of Titanium Alloys—L. D. Jaffe, California Institute of Technology.

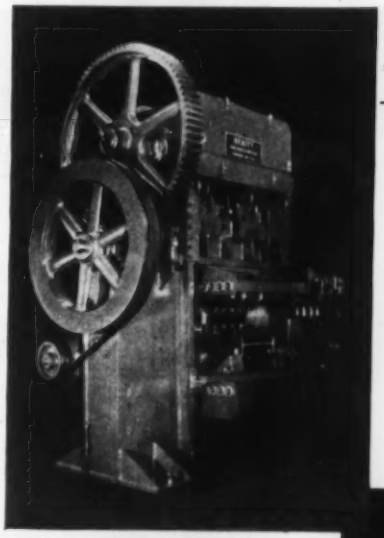
Sigma Nucleation Times in Stainless Steels—G. F. Tisinai, J. K. Stanley and C. H. Samans, Standard Oil Co. (Indiana).

Evidence for Solidification of a Metastable Phase in Fe-Ni Alloys—R. E. Cech, General Electric Co.

Heterogeneous Nucleation of the Martensite Transformation — R. E. Cech, General Electric Co.

Effects of Alloying Elements on the Electrical Properties of Manganin Type Alloys—D. D. Pollock and D. I. Finch, Leeds and Northrup Co.

475° C Embrittlement of Chromized Coatings on Low Carbon Steel—W. L. Chu, General Electric Co.



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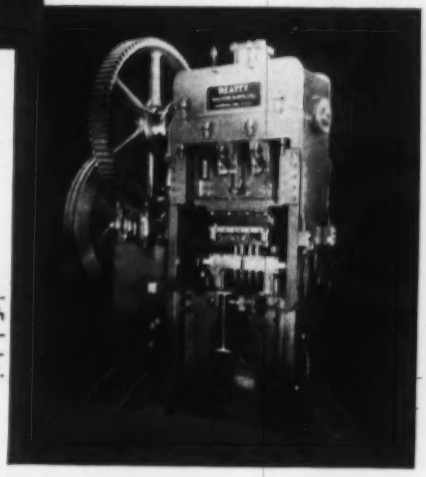
Six individually controlled punching units with automatically synchronized punch and die, facilitate setting up to various gauge lines. 33" max. setting to outside units; 2⅜" min. setting between units. 200 ton cap.



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A turn of a handwheel changes punching centers and synchronizes punch with die. Four punching units, with 2¼" - 6¾" setting between inside and outside punches, adjustable 2¼" - 3½". 200 ton cap.

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BEATTY Gap Type Press for forming, bending, flanging, pressing. 250 ton cap.

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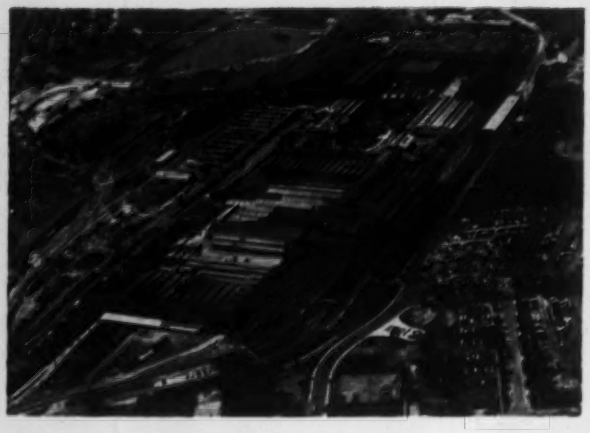

As the American Cast Iron Pipe Company celebrates its Golden Anniversary, we eagerly look forward to what the future holds and pledge even broader and finer service in furnishing centrifugally spun steel tubes.

Already, ACIPCO centrifugally spun steel and cast iron tubes as well as AMERICAN cast iron pressure pipe are at work on every continent, benefitting millions of people served by the paper, petroleum, chemical, textile, water and sewage works, gas and other industries.

During its first 50 years, the American Cast Iron Pipe Company has served industry . . . and people . . . in many ways — providing castings for everything from oxen shoes to rocket parts . . . from bathtubs to refinery tubes. ACIPCO's first half-century has been a period of achievement — in growth, in production, in development, and in service.

Today, ACIPCO is prepared — with complete, integrated facilities for the production of quality steel tubular products — to serve even better the ever-growing needs of modern industry . . . and modern people!

ACIPCO centrifugally spun tubes can be furnished in all the alloy and plain carbon grades, heat and corrosion resistant grades, plain or alloy cast irons, or in special non-standard analyses. Find out why ACIPCO can serve your tubular products needs better. Consult our experienced engineers and metallurgists . . at no cost or obligation.

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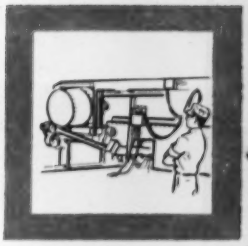
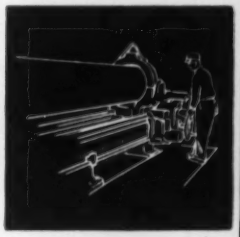


Steel, produced to exact analysis requirements in ACIPCO's electric furnaces, is centrifugally spun to required dimensions. Outside diameters range from 2.25" to 50"; wall thicknesses from .25" to 4".

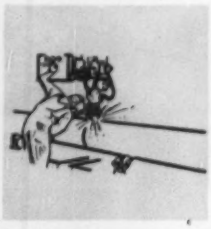
Heat Treating

Modern automatic equipment is used by ACIPCO for uniform heat treating and quenching. Exacting control assures the specified combination of mechanical properties.

Machining



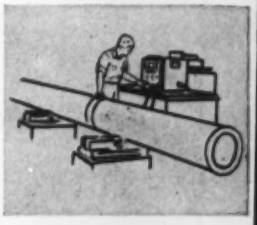
Complete machine shop facilities enable quality steel tubes to be supplied with any degree of finish, from as cast to finish machined, including honing. Shipping time and freight charges are reduced by this integrated service.



Fabricating

Extensive fabricating facilities are another feature of ACIPCO's "under-one-roof" operations. Skilled craftsmen produce special shapes by welding rolled plate or forged parts to ACIPCO steel tubes.

Testing and Inspection



Quality control is rigidly maintained from furnace to finished product. Extensive facilities are available for testing and inspection by all modern, nationally recognized methods to insure sound steel tubes of the highest quality.

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50th ANNIVERSARY
ACIPCO
1905 1955

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"Yep, It's Like Talking to an Old Friend when I Call Lamson & Sessions"

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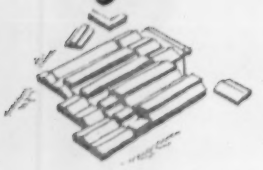
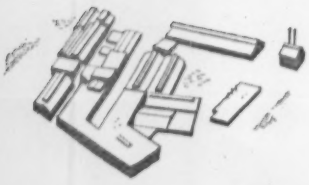
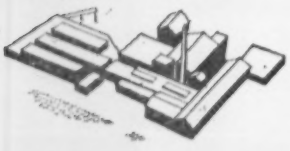
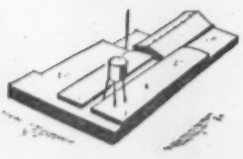
But not at all. I call 'em up and it's just like having an old friend at the other end of the wire. Glad to hear from me, helpful and anxious to please . . . that sort of thing.

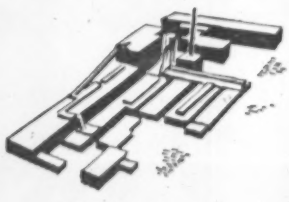
I tell you, it gives a guy a lift to deal with folks like that. Guess it's true that "the bigger they are . . . the bigger they act". Call 'em up sometime and see!











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EXHIBITORS

Philadelphia's Convention Hall will house all exhibits. The exposition opens at 12 noon, closes at 10:30 p.m. on Monday, Tuesday and Wednesday. Thursday and Friday, hours are 10 a.m. to 6 p.m. Following are exhibitors and the booths they will occupy.

A.B.C. Die Casting Machine Co., Dolton, Ill. 1877
Acme Tool Co., New York 1051
Acme Steel Co., Chicago 1965
Aeroprojects Inc., West Chester, Pa. .. 634
Air Reduction Sales Co., New York 1750
Ajax Electric Co., Philadelphia 1619
Ajax Electrothermic Corp., Trenton, N. J. 1619
Ajax Engineering Corp., Trenton, N. J. 1619
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Allied Research Products Inc., Baltimore 962
Allis Chalmers Mfg. Co., Milwaukee .. 1558
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American Chemical Paint Co., Ambler, Pa. 518
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American Cystoscope Makers Inc., New York 1678
American Die Casting Machinery Co., Chicago 1571
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American Metal Market, New York 1240
American Nickeloid Co., Peru, Ill. 1275
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American Optical Co., Buffalo 925
American Positive Grip Vise Corp., Willimansett, Mass. 2047
American Pullmax Co. Inc., Chicago .. 1427
American Steel Abrasives Co., Galion, O. 1162
American Wheelabrator & Equipment Corp., Mishawaka, Ind. 1402
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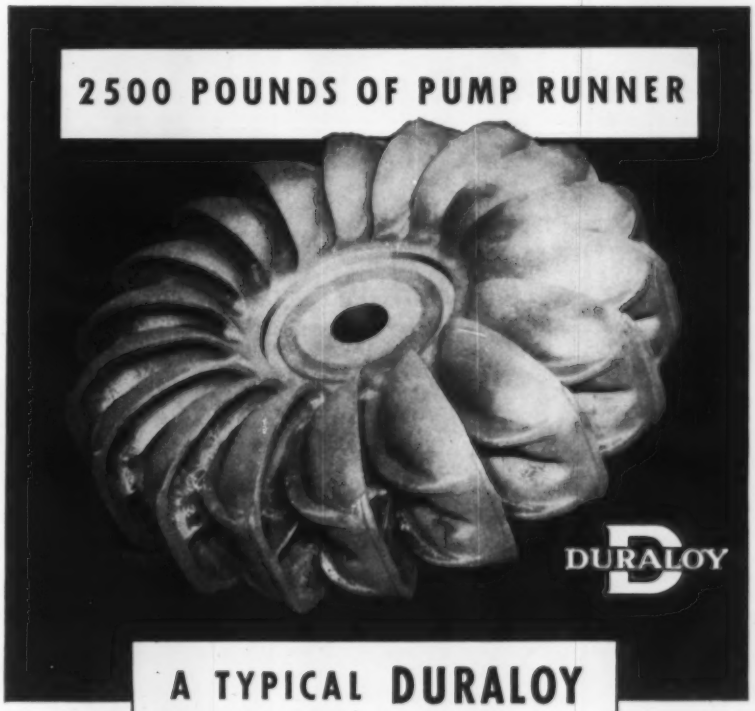

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This casting is 18-8, destined for use under quite corrosive conditions. It's typical of the work done in our modern foundry for both manufacturers who need high alloy castings for their equipment and for plant operators who need castings to meet a corrosion problem, a high temperature problem or a combination of both, with or without abrasion as a contributing factor.

We here at Duraloy now offer several distinctly different kinds of castings, all in the corrosion-resisting, heat-resisting or abrasion-resisting class and each kind offering certain distinct advantages:

static sand castings

centrifugal castings

shell molded castings

Shell molding offers great economy in the casting of small pieces on a large mass production basis.

Bring your high alloy casting problem to Duraloy both for recommendations as to the best alloying combination and for foundry services in casting and finishing the piece. Our recommendations and service are backed up by more than thirty years high alloy casting experience.

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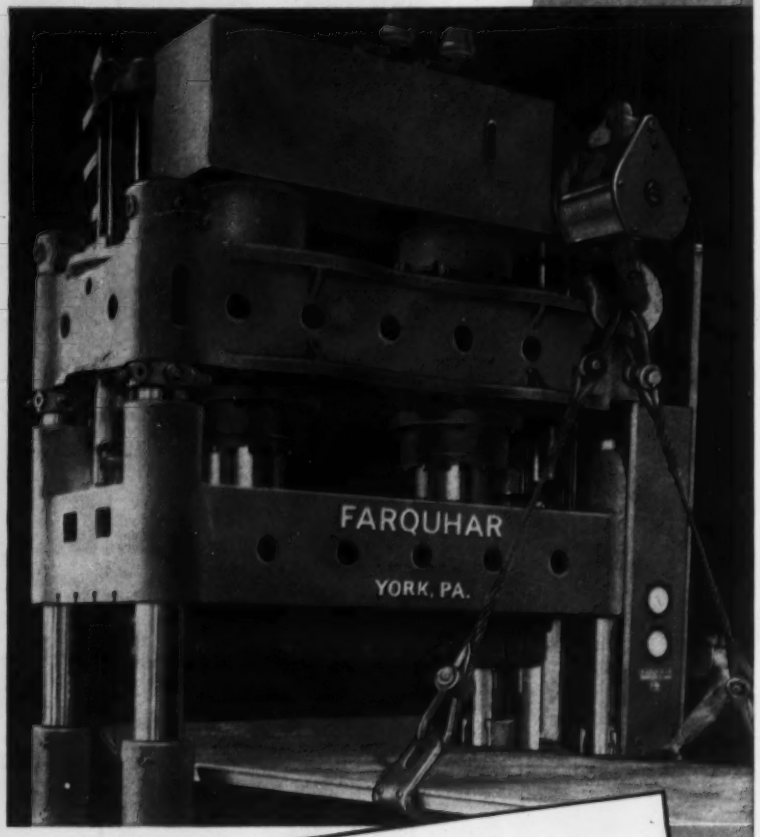

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Baird Associates Inc., Cambridge, Mass. 852
Baldwin-Lima-Hamilton Corp., Philadelphia 1954
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Bede Products Corp., Amherst, O. 1381
Bendix Aviation Corp., South Bend, Ind. 1525
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Eutectic Welding Alloys Corp., Flushing, N. Y. 1225
Exomet Inc., Conneaut, O. 2128

Fab-Alloy Co., Jackson, Mich. 2116
Fairchild Engine & Airplane Corp., Farmingdale, L. I., N. Y. 1808
Falstrom Co., Passaic, N. J. 651
Fawick Corp., Cleveland 507
Fenway Machine Sales Co. Inc., Philadelphia 2247
Firth Sterling Inc., Pittsburgh 740
Foxboro Co., Foxboro, Mass. 1377
Franklin Control Corp., Milwaukee 2165

Gas Appliance Service Inc., Chicago 1932

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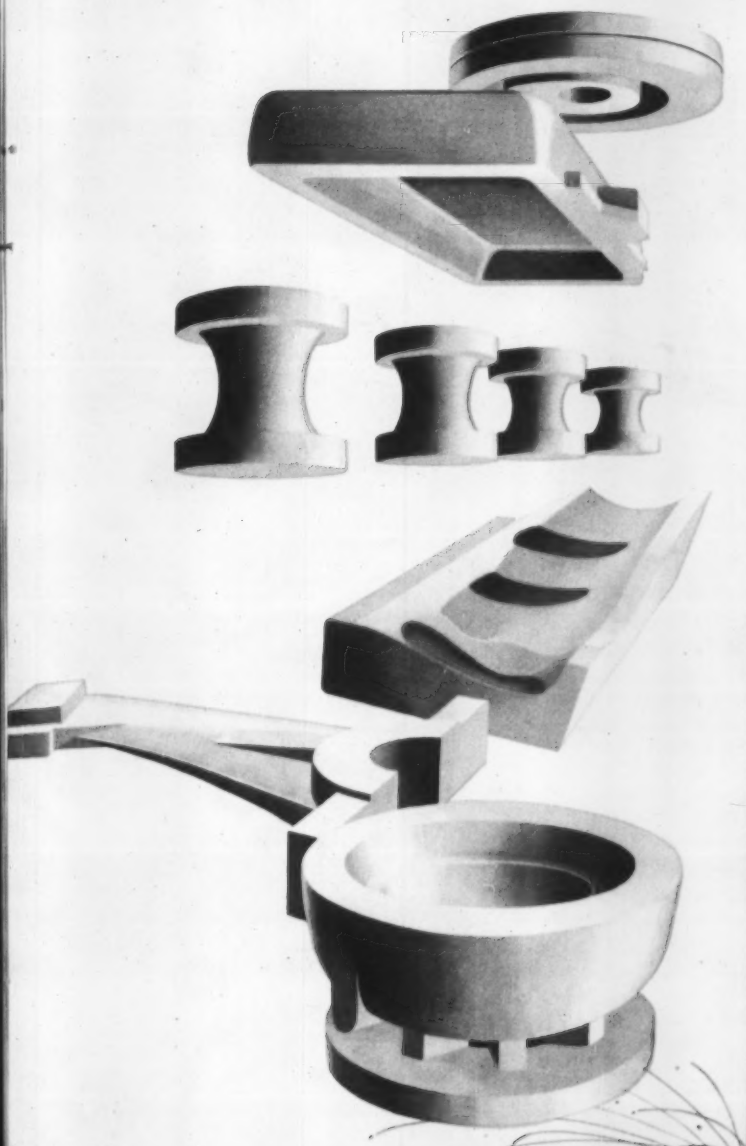

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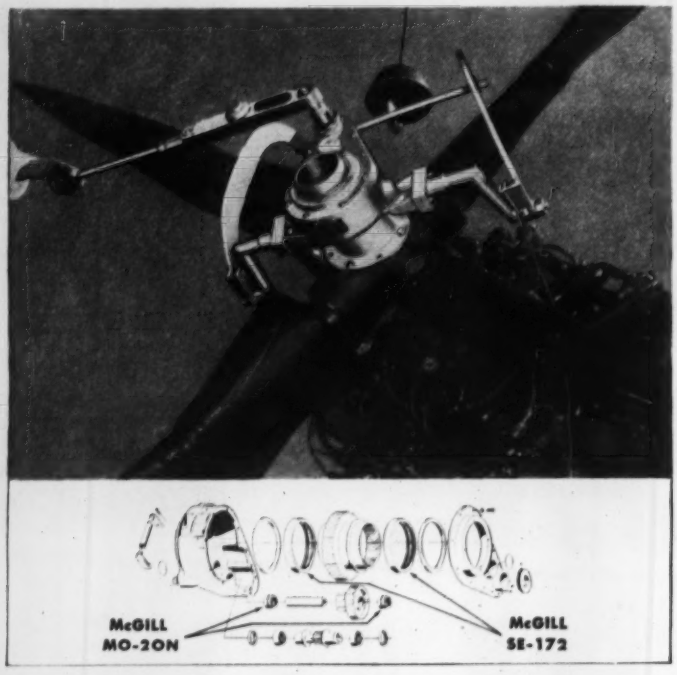


MULTIROL® SE bearings transmit torque up to 10,000 ft. lbs. in Sweeney POWERENCH for aircraft engine maintenance

Equipped with MULTIROL bearings, the Sweeney 8000 series POWERENCH uses an 11.2 to 1 gear ratio so that one man can apply torque up to 10,000 ft. lbs. Four MULTIROL SE bearings on output and gear cluster shafts carry these heavy torque loads while tightening multiple blade propeller nuts to the prescribed tension.

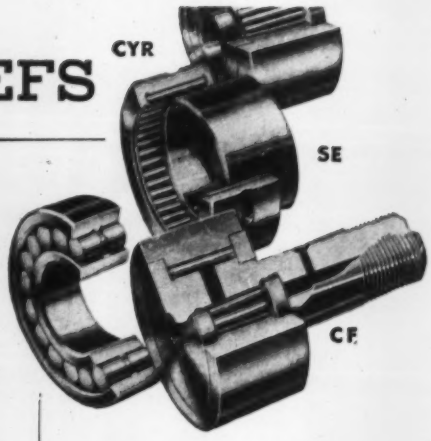
Other models are used to apply torque to diesel locomotive head nuts and main bearings and various heavy industrial engine applications. They rely on MULTIROL SE bearings for their precision dependability and heavier load capacities in smaller radial space.

In eight years, thousands of these unusual tools have been put in service. There has never been a record of MULTIROL bearing replacement.

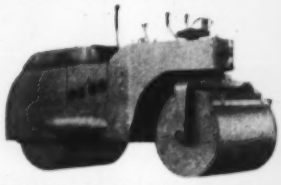
For more capacity in a smaller space, and design advantages such as lubrication reservoirs above roll ends, one-piece outer and roller retaining end shoulders and the sealing effect of close end shoulder and shaft clearance, specify McGill® Bearings.

BEARING SELECTION GUIDE

A revised 140-page Bearing Selection Guide, complete with 30 pages of vital engineering data, has been released by McGill Manufacturing Co., Inc. Ask for Catalog No. 52.



BUFFALO-SPRINGFIELD ROAD ROLLERS LENGTHEN PARTS LIFE WITH SE BEARINGS



MULTIROL SE Bearings support the swivel pin which, as part of the king pin and yoke assembly, permits the guide and drive roller to travel smoothly over rough ground. Replacing bronze bushings, the SE bearings have simplified lubrication and greatly improved life for the yoke assembly and king pin.

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General Dynamics Corp., Bayonne, N. J. 951
General Electric Co. (Apparatus), Schenectady, N. Y. 1572
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Jiffy Tool Supply Co. Inc., Ferndale, Mich. 2140
S. C. Johnson & Son Inc., Racine, Wis. 750
Jomac Inc., Philadelphia 1070

Kasson Die & Motor Corp., Long Island City, N. Y. 1277
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C. M. Kemp Mfg. Co., Baltimore 1801
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L. R. Kerns Co., Chicago 1250
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Kolcast Industries Inc., Cleveland 1561
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Lord Chemical Corp., York, Pa. 1059
Los Angeles Dept. of Water & Power, Los Angeles 1977
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Machinery, New York 1211
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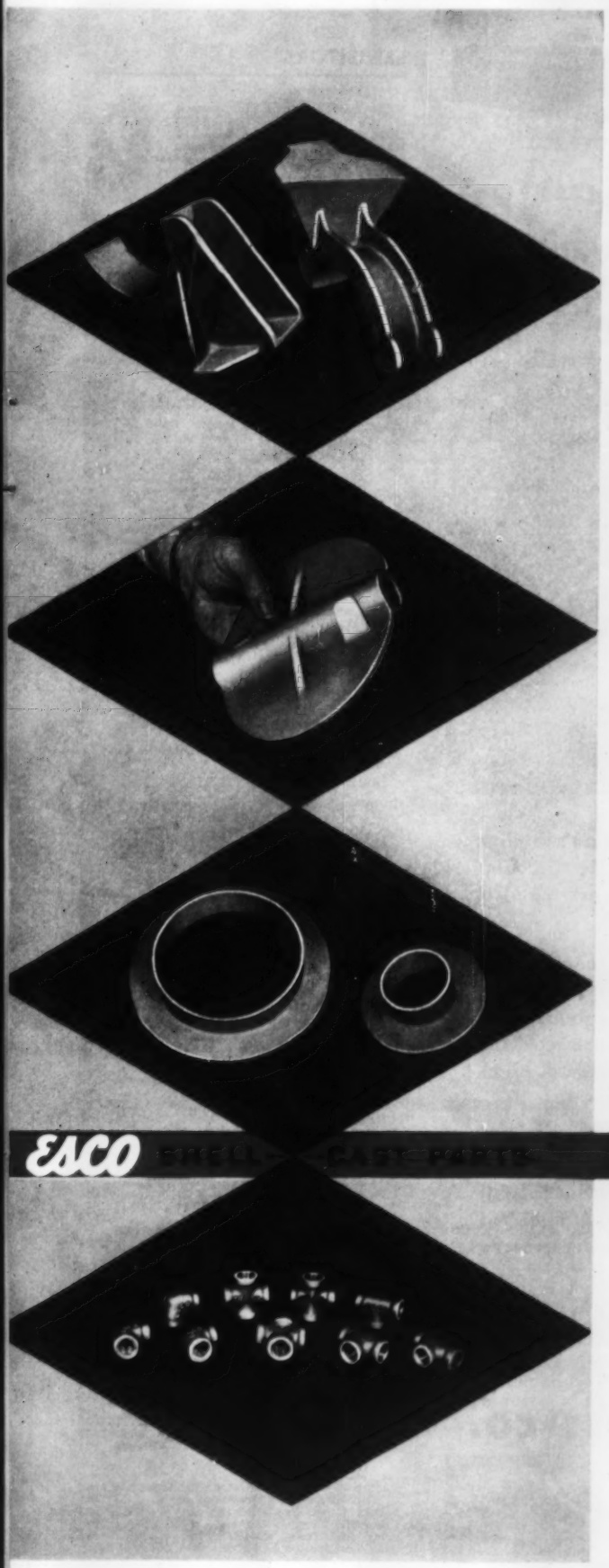

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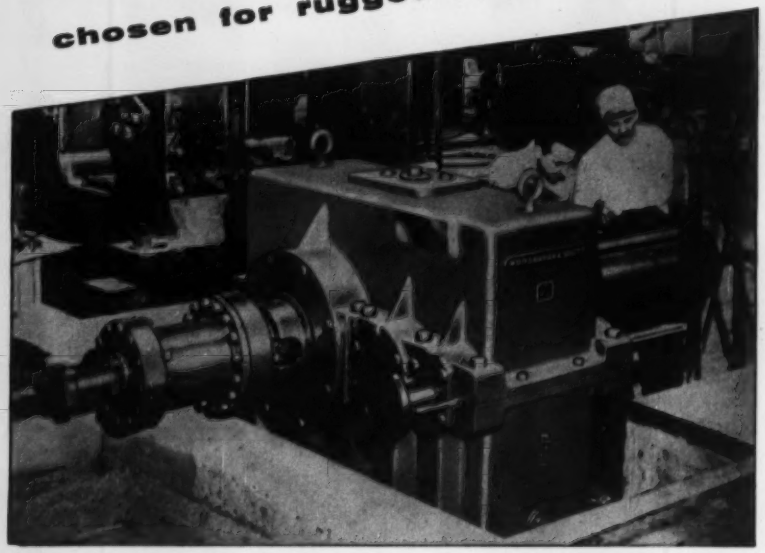

Based on past performance records, one of the nation's leading steel producers specified an H & S RD-4000-H Herringbone Speed Reducer to drive the tension reel on their new 26 inch skin pass mill for cold finishing stainless steel.

This is just another example of the reliable engineering construction and quality built into every H & S speed reducer whether it is a Worm Gear, Helical or Herringbone type. Self-lubricated, they are simply but ruggedly constructed for long-lived efficiency. They permit the use of standard, high-speed motors that are more efficient and economical.

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Olin Mathieson Chemical Corp., East Alton, Ill. 524
Tinius Olsen Testing Machine Co., Willow Grove, Pa. 1428
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Osborn Mfg. Co., Cleveland 718

Pangborn Corp., Hagerstown, Md. 1032
Pantex Mfg. Corp., Pawtucket, R. I. .. 2015
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Randall Mfg. Co., New York 550
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Reed-Prentice Corp., Worcester, Mass. . 602
Reeves Pulley Co., Columbus, Ind. 445
Reid-Avery Co. Inc., Baltimore 1519
Rockwell Mfg. Co., Pittsburgh 1530
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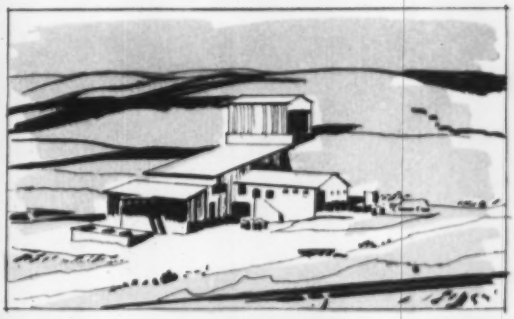

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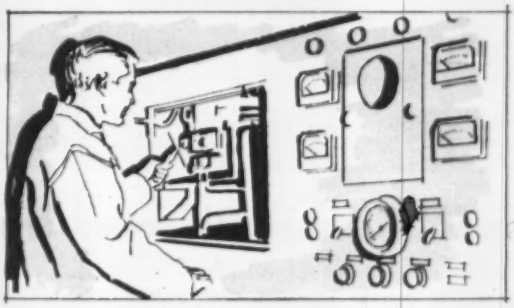

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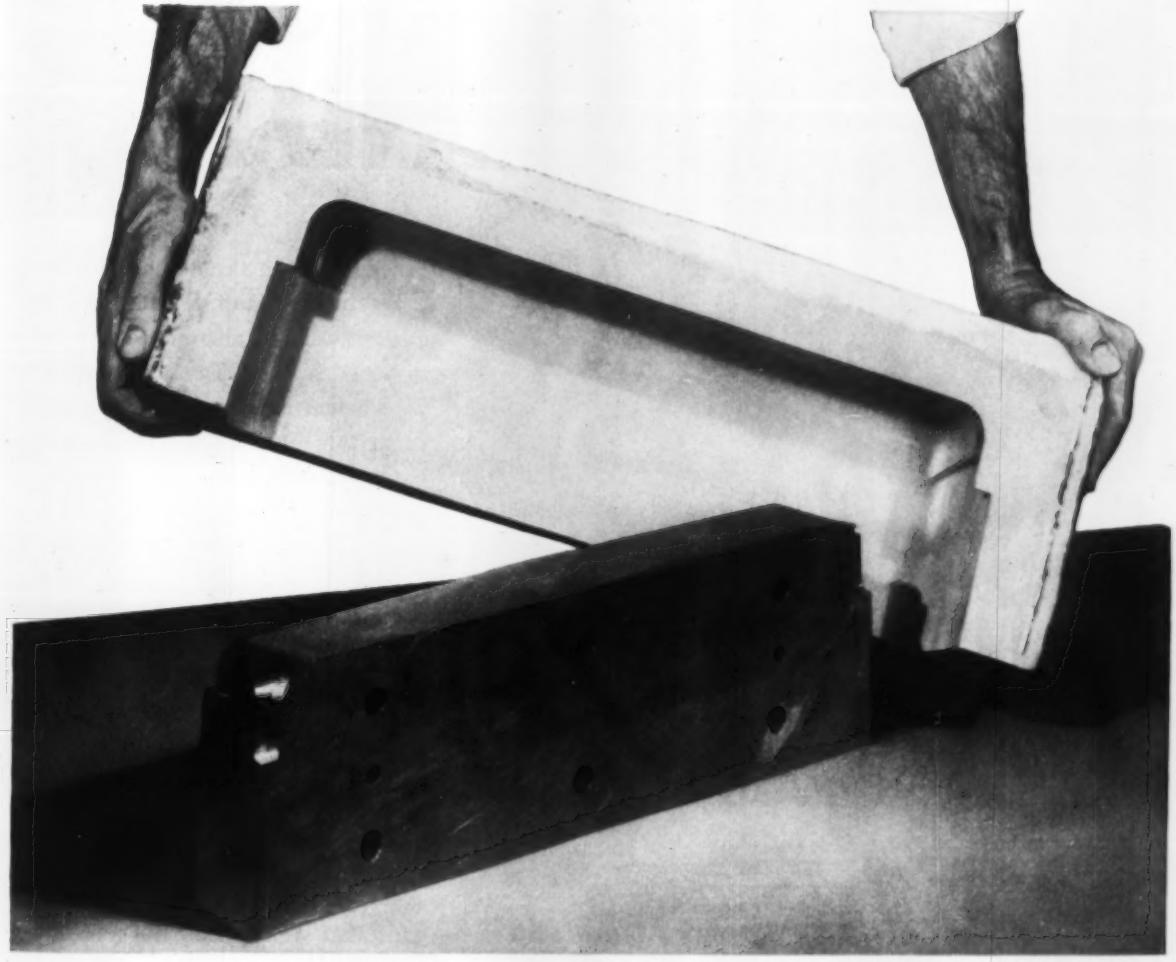

"Rezolin" Toolplastik Compound forms the concave die model shown here with the machined aluminum model around which it was cast. A "Keller" duplicator will be used to reproduce the plastic model in steel. This method saves five days, with an estimated 25 per cent reduction in production costs. Based on BAKELITE Epoxy Resins, this tooling compound is produced by **Rezolin, Inc., Los Angeles 25, Calif.**

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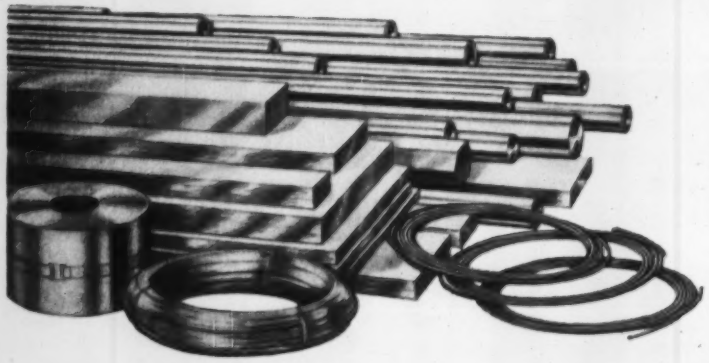

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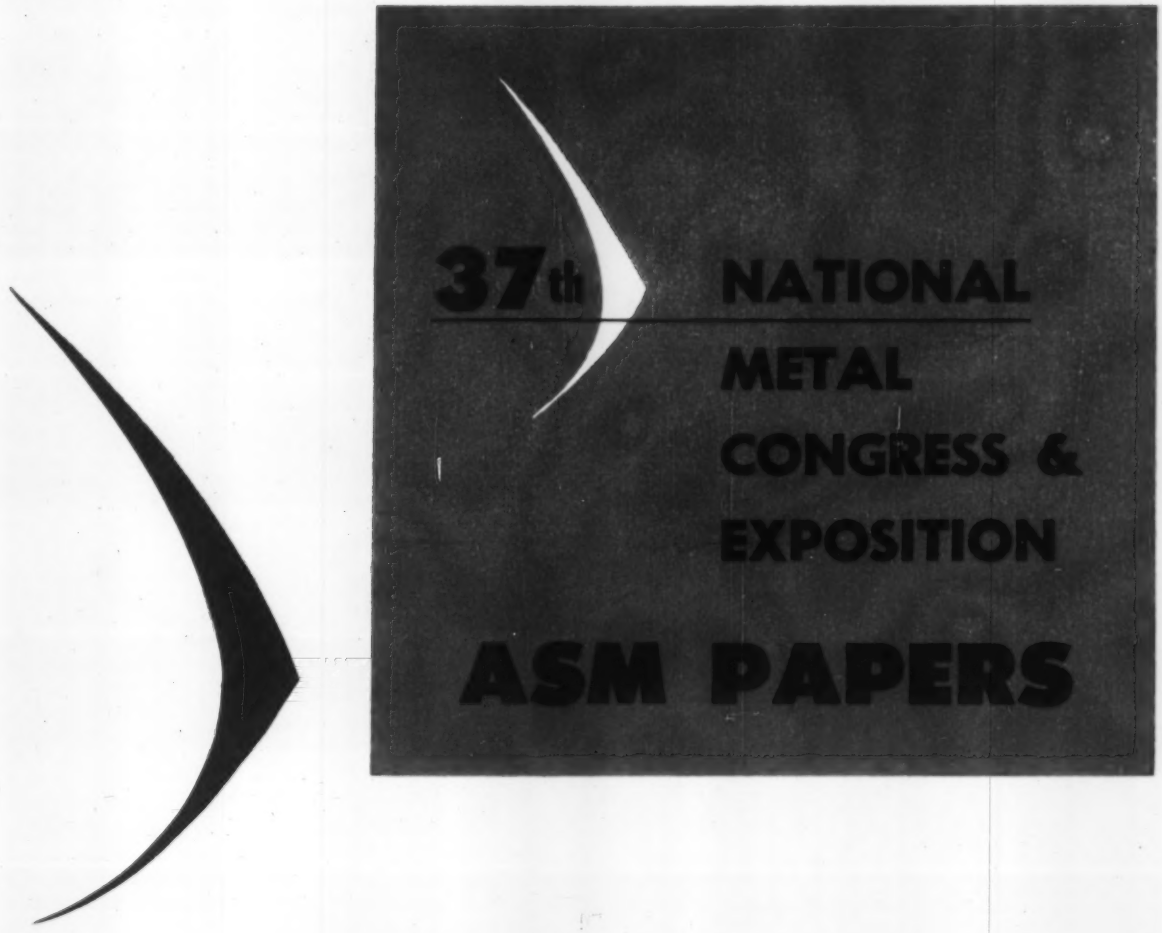

Spotlight Is on Metals

STAINLESS

High Nitrogen Austenitic Cr-Mn Steels—These materials were prepared with special pressure melting and casting techniques. Combining nitrogen-bearing ferroalloys as charging materials and an external pressure of several atmospheres of nitrogen gas, sound ingots were cast. They contained about one-half per cent nitrogen (by weight) in solid solution.

The elevated temperature properties of the base composition, 16 Cr-14 Mn-2 Mo-½ N, and several of its modifications, were found to be equivalent to those of the commercial alloy 16-25-6, in the temperature range of 1200 to 1400°F. The hot strength and satisfactory ductility of these alloys, plus the retention of an austenitic matrix at elevated temperatures, can be attributed, in large measure, to the unusually high nitrogen content.

The alloying elements wolfram (tungsten), silicon, niobium (columbium), vanadium and nickel were qualitatively appraised for their effect on the creep rupture strength of Cr-Mn-N steels. None of these elements was found to be superior to molybdenum. While several percent of nickel appear to be beneficial in stabilizing the austenitic matrix at higher temperatures, its presence severely decreases the nitrogen solid solubility.

The room temperature tensile properties of nickel-free, high-nitrogen austenitic steels are characterized by yield, tensile and ductility values generally superior to those of commercial austenitic stainless steels. In the cold-worked state, the alloys have high tensile strength and good residual ductility.

The oxidation resistance of Cr-Mn-N steels appears to be comparable to that of commercial stainless steels of the same chromium content.

Exploratory studies indicate that conventional welding techniques can be used. A possible exception is the inert-gas, shielded-arc process, where nitrogen or mixtures of it and argon must be substituted for the usual inert gas.

Authors: V. F. Zackay, J. F. Carlson and P. L. Jackson

Influence of Strain Rate and Temperature on Ductility of Austenitic Stainless Steel—The ductility of AISI 303 and 310 was determined in tensile tests over a range of strain rates from 0.01 in./in./min up to 19,000 in./in/min, and over a range of temperatures from −321°F up to +750°F.

Ductility drops as the strain rate is increased, being greatest at room temperature. The ductility shows a maximum at room temperature at a low strain rate, but

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at high strain rates it increases slowly with the test temperature.
Authors: G. W. Form and W. M. Baldwin Jr.

Notch Ductility of Type 410 (12% Cr) Stainless Steel—The influence of composition and heat treatment variables on the notch ductility of this material was investigated. Sharp crack tests of large specimens were used to establish the temperature range of transition from notch-ductile to notch-brittle behavior, and correlation was established with results of conventional Charpy V tests.

Sharp crack tests demonstrated that conventional-type 410 steels (normalized and tempered to tensile strength of 90,000 psi) are susceptible to brittle fracture at warm service temperatures.

The addition of about 0.70 per cent Mo and Ni and the lowering of silicon from the normal 1.0-1.2 per cent to about 0.50 per cent result in material which is highly resistant to brittle fracture at low temperatures.

It is concluded that the brittle failures of type 410 castings may be prevented by use of improved material.
Authors: F. A. Brandt, H. F. Bishop and W. S. Pellini

Creep Rupture Properties of Cold-Worked, Type 347 Stainless Steel—This columbium stabilized stainless was cold worked up to 60 per cent. Recrystallization temperatures were determined for ½, 5 and 50-hour intervals.

In addition to tensile testing at room temperature, creep rupture tests were performed at 1200, 1300, and 1500° F to study: 1. The effects of cold work on the high temperature properties. 2. To relate the time-temperature values for the incidence of intercrystalline fracture to the static recrystallization temperature.

Static recrystallization studies and creep rupture tests confirm that recrystallization can come at a temperature 200°F lower during creep rupture than in static tests.

Useful high temperature strengthening in creep rupture can be achieved through cold or warm work as follows:

1. At 1200°F, up to 30 per cent cold reduction yields improvement up to at least 1000 hours.
2. At 1300°F, up to 10 per cent cold reduction for a 1000-hour life and over 30 per cent for a 1-hour life or less.
3. At 1500°F, up to 20 per cent cold reduction for a 1-hour life but avoid cold work for rupture

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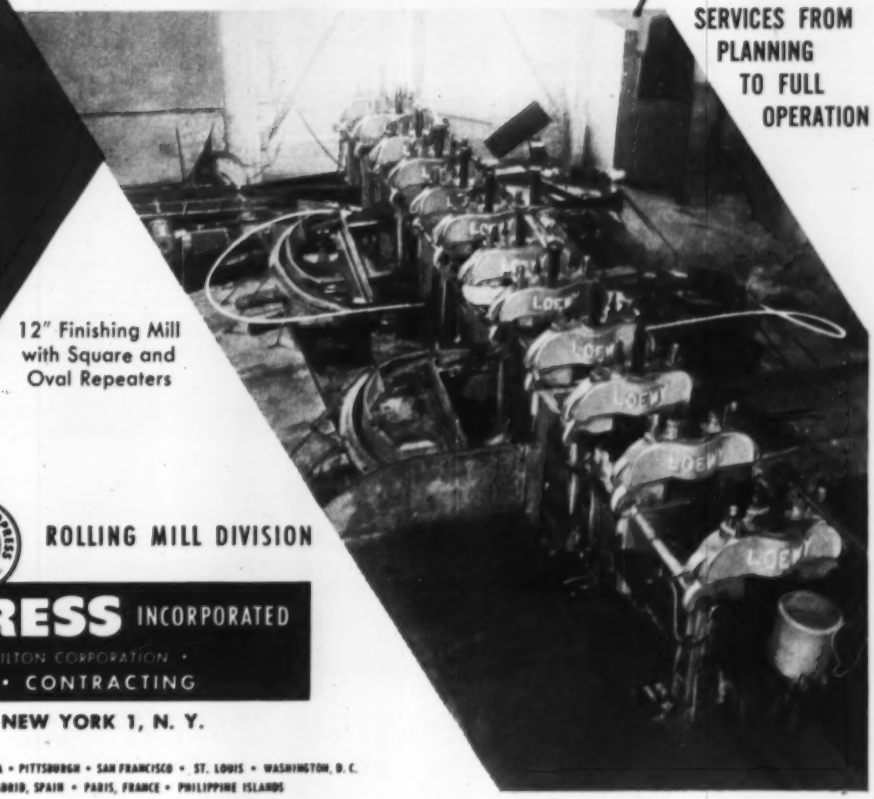

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lives of greater than about 1 hour (the solution treated condition is best).

4. At 1100°F and lower, it appears that significant improvements can be achieved for long time use with cold work up to 30 per cent or more.

Authors: N. J. Grant, Albert G. Bucklin and Warren Rowland

Influence of Alloying Elements on Impact Transition Behavior of 12% Cr Steels Aged at 900° F—The effect of varying amounts of carbon, chromium, molybdenum, aluminum and titanium upon the V-notch Charpy transition temperature of this material (aged for 10,000 hours at 900° F) was determined.

Higher (0.08 per cent) carbon content favored slightly lower transition temperatures for AISI type 410 steels in the annealed condition. An increase in transition temperature was observed for all combinations of carbon and chromium contents after aging for 10,000 hours at 900°F.

Contrary to published information, 0.25 per cent aluminum (AISI type 405) appeared to have no influence on the transition temperature. While the addition of 0.50 per cent molybdenum minimized the increase in transition temperature, the combined addition of molybdenum and aluminum appeared to eliminate it entirely.

A grain boundary network of fine lamellar precipitate, which appeared to be carbides and/or nitrides, was present in every case with an increase in transition temperature.

Authors: E. J. Whittenberger and E. R. Rosenow

Effects of Chemical Composition and Heat Treatment Upon Microstructure and Corrosion Resistance of AISI Types 309 and 310—These stainless types, with varying carbon and nitrogen content, were subjected to different solution annealing treatments and cooling rates. Corrosion tests were conducted in boiling 65 per cent nitric acid and copper sulphate-sulphuric acid.

Type 310—Excellent correlation was observed between distribution of carbides and corrosion resistance in both tests.

The best resistance to corrosion after slow cooling from the solution annealing temperature was obtained when the microstructure contained a random distribution of undissolved carbides which acted as nuclei for the carbon precipitation.

When the microstructure prior to solution annealing contained intergranular carbides or when the carbides were completely dissolved during solution annealing, the steel became susceptible to intergranular corrosion after slow cooling from the solution annealing temperature.

When the carbides were randomly dispersed and when the solution annealing temperature was such that only about 50 per cent of the carbides were dissolved, corrosion resistance of the 0.16 per cent carbon type 310 steel was equal to that of the 0.06 per cent carbon type 310 steel after slow cooling from the solution annealing temperature.

Type 309—A fair correlation was observed between the distribution of carbides and corrosion resistance in boiling 65 per cent nitric acid and copper sulphate-sulphuric acid. Banding and segregation of carbides were more prevalent in the type 309 steels than in type 310. This, in turn, affected somewhat the correlation between the grain boundary carbides and corrosion resistance.

At the low or commercial nitrogen levels tested, improved corrosion resistance was obtained in type 309 with a low solution temperature which resulted in only partial solution of randomly distributed carbides. In this respect, the data were similar

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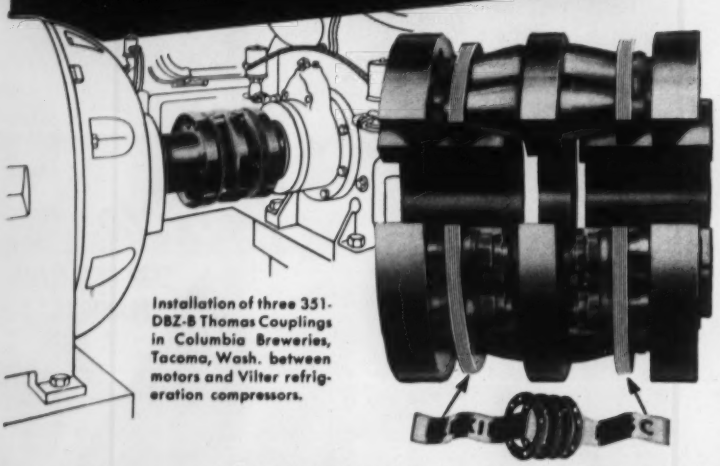

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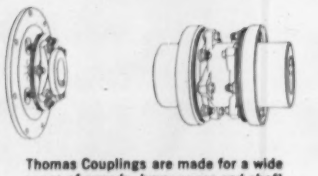

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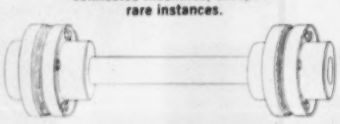

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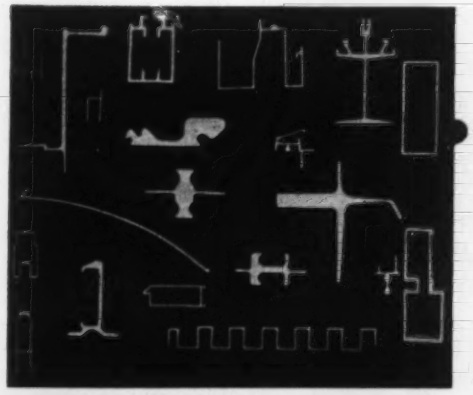

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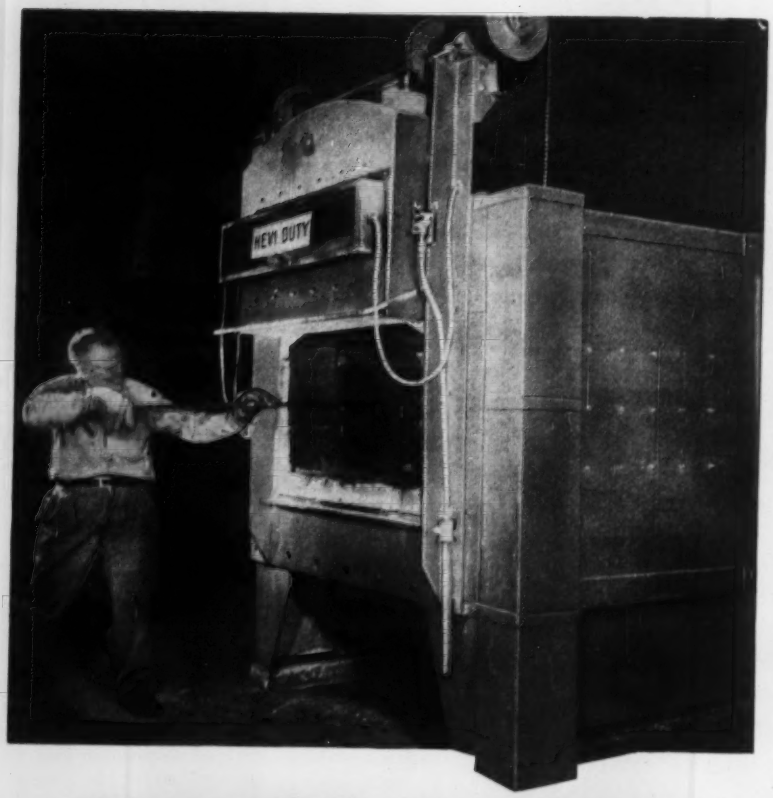

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TECHNICAL PAPERS

to those of type 310. With the higher nitrogen levels, the low solution temperatures did not greatly improve corrosion resistance when slow cooling rates were used from the solution temperature.

Increasing the nitrogen content of the low (0.06 per cent) carbon type 309 heats appeared to be beneficial in increasing intergranular corrosion resistance. However, increasing the nitrogen content at the high (0.16 per cent) carbon level had little effect on the intergranular corrosion resistance of the type 309 steels.

In type 309 steels, if rate of cooling from the solution annealing temperatures is slow, adjustment of the composition to produce 20 per cent delta ferrite will markedly improve intergranular corrosion resistance by minimizing intergranular carbide precipitation. However, in some cases severe embrittlement was observed in type 309 containing a higher percentage of delta ferrite.

Authors: D. J. Carney and E. R. Rosenow

VANADIUM

Properties of Vanadium Consolidated by Extrusion—Extrusion is a feasible technique for consolidating ductile vanadium *reguli* produced by the bomb reduction of V_2O_5 with calcium. Simultaneous consolidation and shaping of vanadium by extrusion results in a dense, sound product with satisfactory mechanical properties and excellent cold fabrication characteristics. Contamination of the reactive vanadium with oxygen and nitrogen during processing is minimized.

The tensile properties of the extruded vanadium are similar to those of ingot iron; they are characterized by moderate strength and high ductility. The ductility of the extruded product is further demonstrated by the excellent cold fabrication characteristics in tube drawing.

The temperature range of softening for extruded vanadium, which was cold reduced 60 per cent in area and annealed 1 hour, is 932 to 1652° F. Metallographically, recrystallization occurs between 1382 and 1652° F. An anomaly, attributed to age hardening, is in the softening curve between 1112 and 1472° F.

Authors: C. E. Lacy and C. J. Beck

Mechanical Properties of Vanadium-Base Alloys—In its unalloyed form, vanadium may be regarded as a low-strength, ductile metal. Its ductility, as in titanium, zirconium and other high-melting point transition ele-

ments, is severely limited by the content of interstitial elements—oxygen and nitrogen—held in solid solution.

Accordingly, melting and heat treatments must be designed to prevent any increase in the existent level of interstitials. Because of this and because of its high melting point (3452° F), it would seem that vanadium and its alloys will have to be melted in the cold-mold, arc-melting furnaces in use for titanium and zirconium alloys.

Although a large number of elements have appreciable solid solubilities in vanadium, only one of the binary systems, vanadium-titanium, permits forgeability beyond 10 per cent alloy addition. The V-Ti alloys are forgeable over the whole range of compositions.

Certain elements in small additions develop anomalous minima in hardness and tensile strengths which in some instances are significantly lower than unalloyed vanadium. Titanium and zirconium are particularly remarkable in this respect. An alloy containing 2.5 per cent Zr has considerably more tensile ductility than unalloyed vanadium. A sheet specimen cold rolled to more than 90 per cent reduction in area can still be bent over a sharp mandrel to nearly 180 degrees.

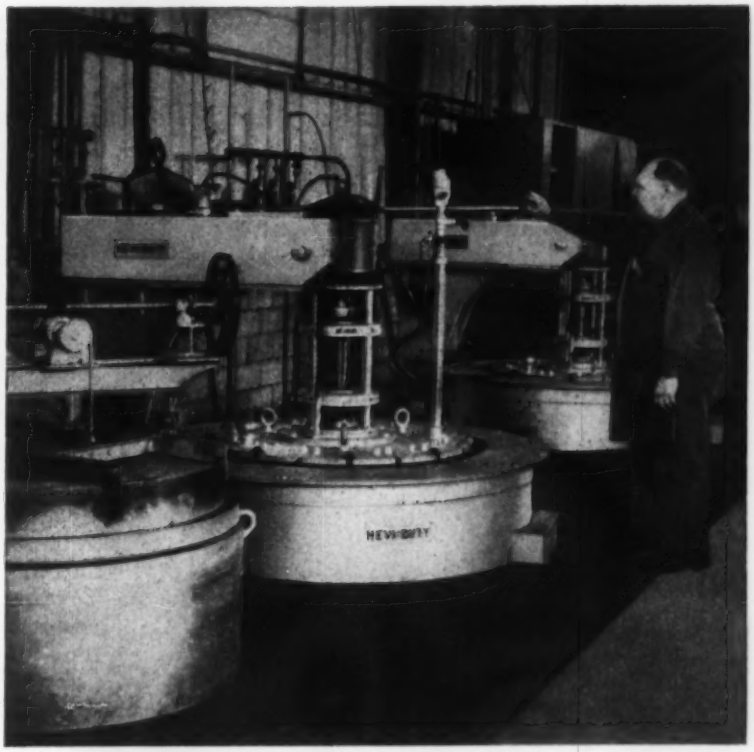
Nearly all the forgeable binary alloys have low tensile strengths and negligible tensile ductilities. Outstanding exceptions are binary alloys containing up to 50 per cent Ti and up to 3 per cent Zr. The goal of high-strength and high ductility can be achieved only in polycomponent alloys based on vanadium-titanium and vanadium-zirconium.

Testing showed that only the V-Ti-X alloys, where X is a third addition or more, could develop high strength levels. Single-phase solid solution alloys based on V + 40-50 per cent Ti can develop room temperature strengths up to 170,000 psi.

While the over-all strength of unalloyed vanadium is relatively low, the rate of decrease with temperature is also low, with the result that even at 1652° F, vanadium retains strengths of about 15,000 psi. Judged on a strength to density basis (density of vanadium is 6.0 grams per cc), this is nearly equal to molybdenum.

A systematic program of hot tensile testing of vanadium alloys showed that the elevated temperature strengths in the range of room temperature to 932° F could be raised to substantially higher levels than those shown by unalloyed vanadium.

For instance, unalloyed vanadium



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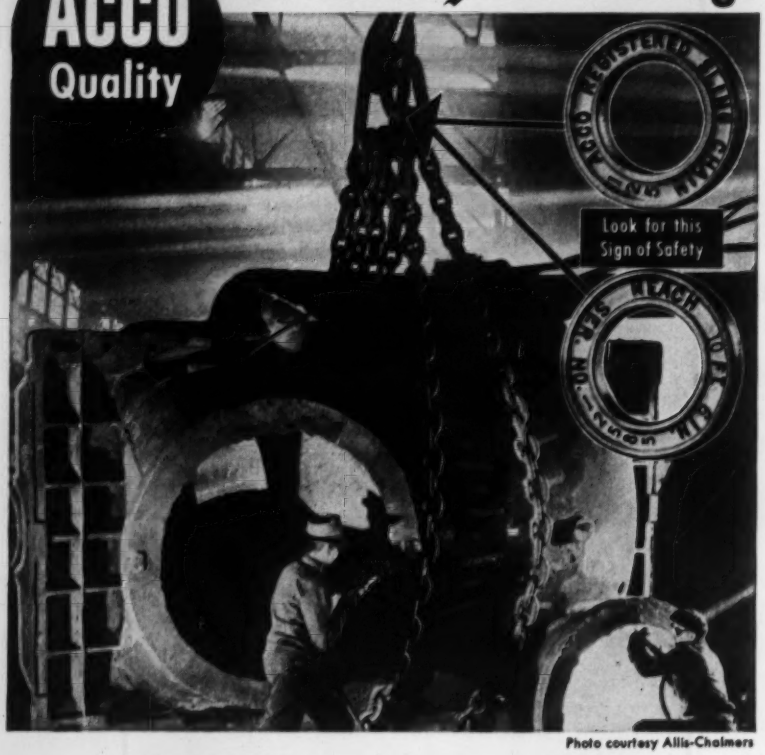

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at 932° F has a tensile strength of 57,000 psi. An alloy containing 50 per cent Ti and 5 per cent Si had a strength of 158,000 psi. Above 932° F, all alloys showed sharp progressive drops in strengths converging near 1652° F. At this temperature, strengths vary between 15,000 and 50,000 psi. It would appear that at about 2012° F, all alloys would have about the same strength.

The excellent high temperature tensile strengths were taken as a preliminary indication of useful creep strengths, especially when judged on a strength to density basis. The stress-rupture behavior of a number of alloys was studied in the temperature range 932-1292° F. Alloy groups included V-Ti-Cr, V-Ti-Al and V-Ti-Al-C, as well as alloys of V-Ti-Al using alumino-thermic vanadium as an alloy base.

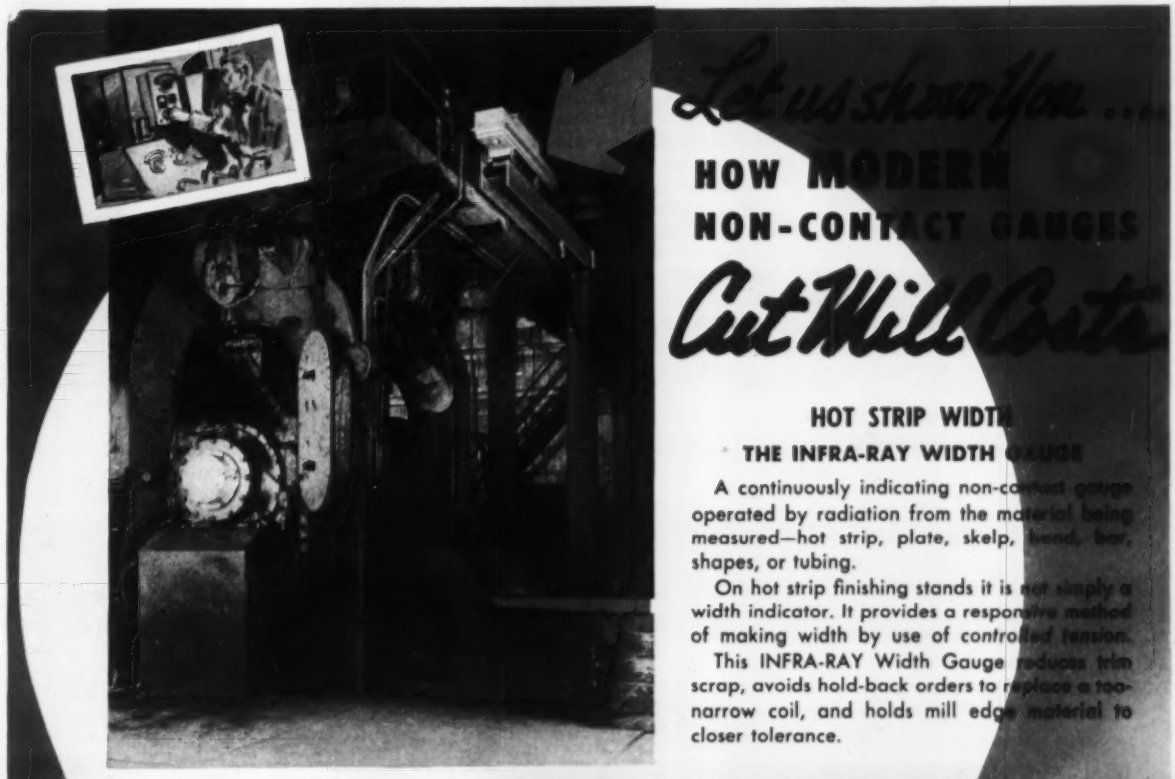
Certain vanadium alloys were developed which were at least equal, and probably marginally superior, to the best so far developed in titanium-base alloys. In the temperature range 752-932° F, there is an unquestioned superiority of the vanadium and titanium alloys over the nickel-base, cobalt-base and iron-base alloys when judged on a stress-to-rupture by density parameter.

Carbon additions have been shown to improve the forging characteristics of vanadium alloys without impairing mechanical properties. In certain instances, carbon additions developed superior ductilities. The presence of free carbides does not seem to affect the stress-rupture behavior.

The majority of this work made use of vanadium metal produced by a calcium reduction process. This metal is of comparatively high purity and is ductile in the unalloyed state. A new vanadium metal, produced by an alumino-thermic reduction process, is currently available.

This metal contains appreciable amounts of aluminum in solid solution as well as a higher level of interstitials. Accordingly, it is not ductile in its unalloyed state. However, it was shown that when the alumino-thermic metal was used as base material to prepare the V + 40-50 per cent Ti + 5-10 percent Al alloys, the alloys were similar in mechanical behavior to the same compositions produced with calcium-reduced vanadium.

Vanadium alloys have potential application as high strength materials at elevated temperatures up to 1252° F, at which temperature V_2O_5 melts and catastrophic oxidation occurs. Above that temperature suitable oxi-



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dation preventive measures are necessary. The work reported here is of a preliminary nature, but it serves to define areas of interest for further investigation.
Authors: W. Rostoker, A. S. Yamamoto and R. E. Riley

ZIRCONIUM

Tensile Properties of Zirconium-Chromium Alloys: Particle Strengthening Effects—Zirconium, with its low neutron absorption, high temperature of melting and good corrosion resistance, is of interest to the Atomic Energy Commission for use in reactors. It is desirable to raise its strength at elevated temperatures and at the same time maintain its low neutron absorption and good corrosion resistance as much as possible. Chromium is one of the alloying elements that might be used with zirconium because of its relatively moderate neutron absorption (2.9 barns) and known ability to impart elevated-temperature strength and oxidation resistance to other metals.

Tensile properties of zirconium-chromium binary alloys containing up to 18 atomic per cent chromium were investigated for the temperature range 382 to 932° F. Highest yield strength obtained at 932° F was about 26,000 psi (for the 18 per cent chromium alloy). No significant solid-solution hardening in alpha zirconium hardening was observed. A linear relation between the flow stress and volume fraction of the compound was observed.

The particle-hardening effect increased with strain in the range of true strain 0.002 to 0.05, and made a greater total strengthening contribution at lower temperatures. The normalized (per cent) increase in strength was essentially independent of testing temperature except at the highest temperature where the alloys showed signs of instability.
Author: J. H. Keeler

Progress in Development of Creep-Resistant Zirconium Alloys — The eutectoid-type alloying elements, molybdenum, niobium (columbium), tantalum and vanadium, are most effective in strengthening zirconium at temperatures below 932°F. The peritectoid-type alloying elements, aluminum and tin, are most effective in strengthening zirconium at temperatures above 932°F. The peritectoid-type alloying elements are also most effective in improving the creep strength of zirconium at 932°F.

Those ternary zirconium alloys that contain both peritectoid and eutectoid-type alloying elements have been called peritectoid-eutectoid hybrids. These alloys show an extremely wide range of mechanical properties and are noted for the ease with which they can be hot fabricated. Alloys of this type exhibit good strength and ductility at room temperature, and show promise for the development of creep-resistant alloys at 932°F.

The peritectoid-eutectoid hybrids are heat treatable, and can be strengthened by heating into and quenching from an alpha-plus-beta or beta-phase field. This strengthening effect is usually associated with a severe loss in ductility.
Author: W. Chubb

TITANIUM

Mechanical Properties of Ti-Cr-Mo Alloys as Affected by Grain Size and Grain Shape—For unalloyed titanium, grain size or shape has only a minor effect on the mechanical properties. Yield strengths are decreased slightly for specimens annealed in the

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alpha-beta range because of the partition of impurities to the nonmatrix alpha. Impact resistance is highest for the smallest alpha-grain sizes. Bend ductility and tensile ductility are excellent for all grain sizes. The fatigue endurance limit at 10^7 cycles is 79 per cent of ultimate strength for unnotched and 42 per cent for notched specimens.

The grain size of the metastable-beta alloy (Ti7, 5Cr-7.5Mo) also has only a minor effect on the mechanical properties so long as the alloy is single phase. The presence of alpha in the structure lowers the bend ductility, tensile ductility and impact resistance. Notched fatigue properties appear to be relatively unaffected by changes in grain size or microstructural condition. The plates of alpha phase in the beta matrix act as stress raisers similar to notches and lower the unnotched endurance limit of the alloy.

The alpha-beta alloy (Ti-2.5, Cr-2.5 Mo) was tested in the stabilized condition so that the only variables would be grain size and shape. Only minor changes in properties occurred as a result of changing the alpha-beta grain size. Strengths were unaffected by changing grain shape, although the equiaxed alpha-beta specimens had higher tensile ductilities and impact resistance than the acicular alpha-beta specimens. The fatigue endurance limits generally were unaffected by grain size or shape. The unnotched fatigue strength was 34 per cent of the ultimate tensile strength, and the notched fatigue strength was 20 per cent of the ultimate tensile strength.

The fatigue endurance limit of the alloys appears to be unchanged, regardless of alloy content, although the tensile strength is greatly increased as a result of alloy content. The fatigue endurance limit of titanium, at least for rotating-beam tests, probably will not be increased greatly by alloying.

Authors: H. R. Ogden, F. C. Holden and R. I. Jaffee.

Hydrogen Contamination in Descaling and Acid Pickling of Titanium—Descaling and pickling operations were investigated as probable sources of hydrogen contamination. Preliminary tests were made in a commercial sodium hydride descaling bath. Subsequently, the study was extended on a laboratory scale to cover the effects of time and temperature on hydrogen absorption in sodium hydride, Virgo and acid pickling baths.

Subsequent to this work, the jet-engine and airframe industries had problems that were traceable to hydrogen contamination in titanium alloys.

The object of the present work was to demonstrate the magnitude of hydrogen contamination in titanium under various conditions. The sodium hydride bath is a 1.5 to 2 per cent solution of sodium hydride in molten sodium hydroxide. This bath is normally operated at 700-720°F. The Virgo bath has a sodium hydroxide base with some additives. The acid pickle investigated was 10 per cent nitric, 2 per cent hydrofluoric acid.

Significant hydrogen absorption in titanium can occur in a sodium hydride descaling bath and in a 10 per cent nitric, 2 per cent hydrofluoric acid pickle. The amount of hydrogen absorbed increased with increasing ratio of surface area to mass and also with time in the baths. There was a minimum at about 800°F in the hydrogen pickup from the sodium hydride descaling bath. No hydrogen pickup occurred with the Virgo bath, but this treatment resulted in surface pitting. The 8 per cent manganese

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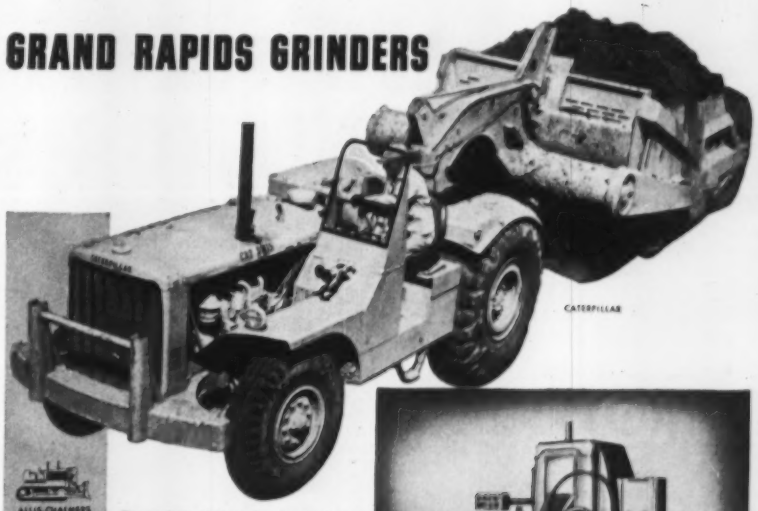

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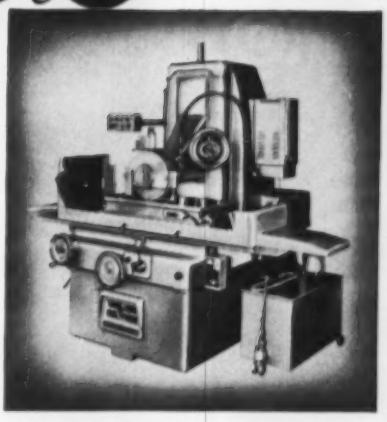

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alpha-beta alloy (C-110M) absorbed more hydrogen than the alpha commercially pure (A-55) titanium.
Authors: G. A. Lenning, C. M. Craighead and R. I. Jaffee

Investigation of Heat Treatability of 6% Aluminum, 4% Vanadium Titanium-Base Alloy—This alloy has a wide range of working temperatures. Varying the working temperature between 1400 and 1750°F has little effect on mechanical properties resulting from any particular heat treatment.

Duplex heat treatments give moderately high strength levels accompanied by good ductilities. In ½-in. sections, tensile strengths from 130,000 to 175,000 psi and yield strengths from 100,000 to 165.000 psi may be obtained.

A 1550°F solution treatment results in the lowest yield-tensile ratio and offers the possible advantages of good machinability and excellent low temperature formability.

The alloy is stable under stress to 800°F and has excellent tensile properties at this temperature. Its fatigue endurance ratio is greater than 0.55 for the heat treatments evaluated.
Authors: R. G. Sherman and H. D. Kessler

MOLYBDENUM

Initiation of Discontinuous Yielding in Ductile Molybdenum—The initiation of yielding under rapidly applied constant stress was investigated in two lots of fine grained ductile molybdenum. One lot was produced by the arc-casting method and the other by powder metallurgy.

Both lots were worked at temperatures below the recrystallization temperature, followed by a recrystallization treatment which produced a rather uniform fine grained structure. These materials exhibited distinct yield points in their static stress-strain relations.

The results show that fine grained ductile molybdenum exhibits the phenomenon of delayed yielding in a form similar to that observed in annealed low-carbon steels. This result lends further support to the view that yield point and delayed yield phenomena are a consequence of the anchoring of dislocations in body-centered cubic metals by interstitial solutes such as carbon and nitrogen.

The present work gives a tentative indication that nitrogen may be more effective than carbon in anchoring dislocations or in strengthening grain boundaries in molybdenum.

A quantitative difference between the delayed yielding behavior of molybdenum and low-carbon steel is that the upper limiting stress in the stress vs. delay time relations may be observed at higher temperature in molybdenum than in steel.

Thus experimental studies of this upper limiting stress phenomenon with a view toward its possible relationship to convential transition temperatures might be more conveniently carried out with ductile molybdenum than with iron or steel.

The initial rate of pre-yield plastic strain in the sintered molybdenum tested at room temperature is found to depend upon the applied stress in a manner which is in agreement with a dislocation theory of delayed yielding. Quantitative comparison of theory and experiment in this respect yields a value for the binding energy of a dislocation in molybdenum with an atmosphere of interstitial solute atoms which is of the same order of magnitude as that found for iron.
Authors: J. A. Hendrickson, D. S. Wood and D. S. Clark

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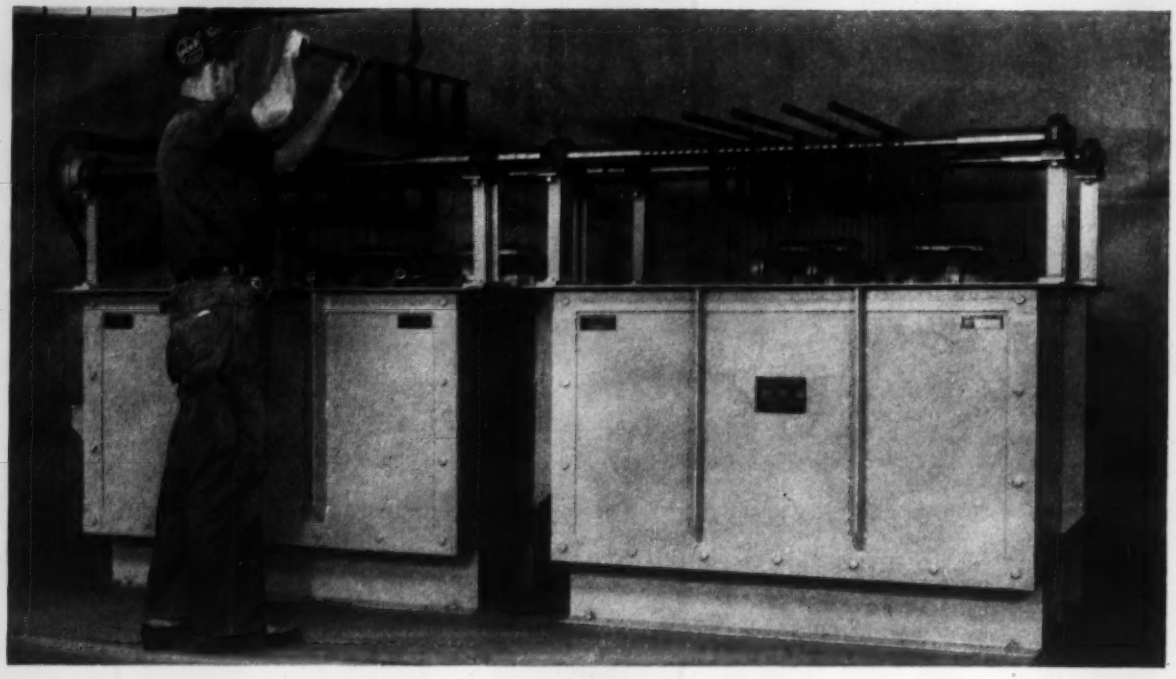

As every metal man knows, heat treatment of steel can be a very tricky and delicate operation. And it can be very expensive if your process suddenly takes a wrong turn somewhere or you're being forced to scrap a painful percentage of your production. For heat treating can no longer be classed as just a craft where skill is enough—it's become an exact science; and Houghton's Engineers and Metallurgists have learned this science from the ground up—inside and out.

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your heat treating results...

High Speed

Because thermal conductivity (heat transfer rate) from liquid salts to metal is much higher than is possible by heat radiation, liquid salts bring parts up to heat faster. Salt baths exclude *all* atmosphere from the metal, prevent scale formation and eliminate need for extra surface treatment.

Precision

You can control the temperatures of liquid salts within two or three degrees throughout the entire bath and thus get positive, uniform results. And you get the same results time after time because Houghton Salt Baths are pure, stable, doubly refined and uniformly formulated for the treatment prescribed.

HOUGHTO-QUENCH ... The Final Step In Any Heat Treatment

With Houghto-Quench Oil you get the speed you need, maximum stability and complete "wet-out" in this all-important finale that makes the rest of the operation pay off. For uniform deep hardness, safety and dependability—specify Houghto-Quench.

You'd be surprised how many steelmen can whistle while they work since they switched to Houghton Heat Treating Products. Why not call in the Houghton Man to see how one or two or *all* of these products can improve your production and lower costs. Or write to E. F. Houghton & Co., 303 West Lehigh Avenue, Philadelphia 33, Pa.

... products of **E F HOUGHTON & CO.**
PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service ...

HERESITE

REG. U. S. PAT. OFFICE

LININGS FOR TANK CARS AND TRAILER TANKS

Courtesy Hooker Electrochemical Co.

RESISTANCE—Heresite linings effectively prevent product contamination of such items as Sulphuric Acid, Rubber Latex, Formaldehyde, Battery Acid, Lactic Acid, Acetic Acid, Fruit Juices and Wine. These products can be delivered fresh and full strength, unchanged.

EASE OF CLEANING—Heresite lined tank cars are quickly cleaned by Steaming, Hot Water, or any type of Solvent Wash.

HERECROL

REG. U. S. PAT. OFFICE

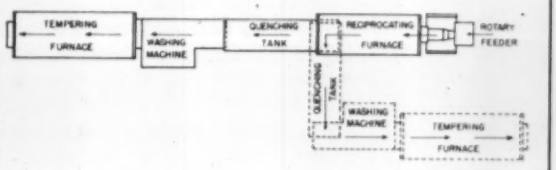
SYNTHETIC RUBBER LINING
The strongest caustic hydroxide solutions, as well as the halogen acids and other chemicals, may be transported in a HERECROL lined tank car or trailer tank. Our literature will interest you. Write for it today.

HERESITE & CHEMICAL COMPANY

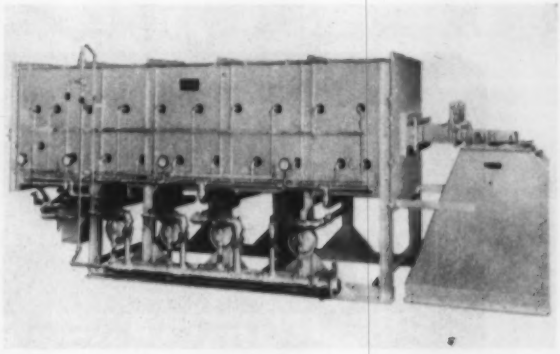
MANITOWOC, WISCONSIN

Branch Office: 327 South LaSalle Street, Chicago, Illinois

Heat Treating Installation Cuts Costs



Solid line shows an inline installation; dotted line shows a reversing loop



This automatic, continuous unit consists of an automatic rotary feeder, a controlled atmosphere reciprocating furnace and an automatic quenching tank.

At the Metal Show it will discharge work into an automatic washing machine and an automatic tempering furnace of the neighboring exhibitor, Metalwash Machinery Co., Elizabeth, N. J.

Output: 100 to 800 lb of controlled atmosphere heat treating, quenching, washing and tempering an hour. A wide range of sizes cuts costs; the unit is suited for a small plant or can be fitted into a production line in a large plant.

The installation can be made either in line or in a reversing loop as illustrated. The reversing loop discharges the work next to the charging end of the furnace and uses a minimum of floor space.

Each part is individually heat treated, quenched, washed and tempered as it passes through the reciprocating furnace. The disadvantages of batch processing are eliminated.

Flexibility permits handling small as well as large production lots on a continuous basis. Large production lots can be interrupted easily to run small batches of urgently needed work.

Work done includes clean hardening and light case carburizing. *Write*: American Gas Furnace Co., Elizabeth, N. J. *Phone*: Elizabeth 2-2120 (Metal Show Booth 1914)

Flame-Cutting Machine Makes Any Shape

Here is an ideal production tool for any size shop. It offers repetitive, accurate shape cutting with a single torch. The machine also serves as an auxiliary unit to supplement the output of larger, more expensive shape-cutting machines.

Any shape up to a 42-in. circle and straight lines up to 92 in. can be cut. A permanently magnetized tracing roller accurately follows metal templates of the most intricate shape.

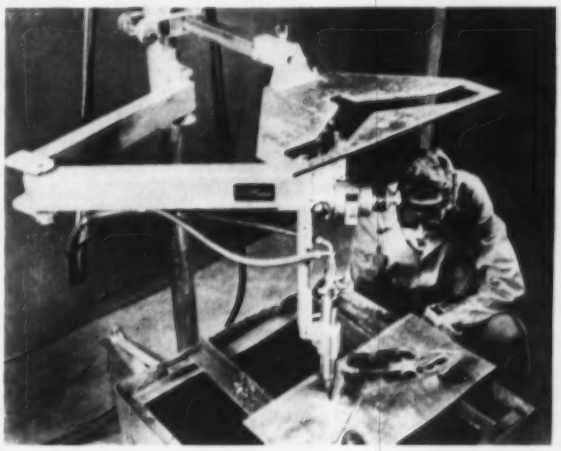
The motor driveshaft of the camograph has a simple worm-gear drive; there are no couplings, pulleys or belts. The machine is portable.

Rectifier Arc Welder—This machine is designed for inert-gas-shielded, consumable-electrode welding. Voltage is constant for all automatic applications using constant-speed wire feed.

The arc welder has a 3-phase transformer and a rectifier bank. Coils are aluminum wound, silicone and glass insulated for lightness and protection against high temperatures and moisture.

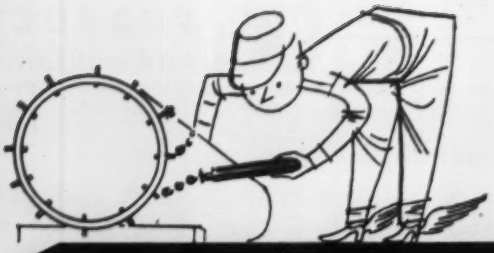
Forced draft cooling is provided by a fan with a reversible ball-bearing motor. Reversing the motor blows dust and lint from the rectifier stack.

Arc voltage may be preset from 15 to 44 arc volts.



Initial voltage may be set higher for ease in starting the arc. Once the arc is established the voltage automatically adjusts to the preset value. It remains constant regardless of the load conditions or changes in input line voltage.

Automatic Welding Head—This unit is designed for



"STUD" NELSON
END WELDS
HEAT EXCHANGER FINS
IN A FLASH!

The trigger-quick NELWELD system offers practical end welding for the attachment of low cost pin fins on heat exchangers. The same system is used on pressure-tight vessels where attachments must be made without piercing the shell.

THREE METHODS OF INCREASING HEAT TRANSFER WITH NELSON STUDS

1. HOLE, TAPERED OR KNURLED PIN, AND STUD
2. STUD ONE SIDE ONLY
3. TWO ACCESSIBLE SIDES

The NELWELD system is quicker and stronger than hand welding . . . costs less because it saves time. It is a method that provides a continuous heat path for maximum heat transfer . . . offers a logical solution to the problem of interior fins . . . provides positive pressure-tight welds . . . a minimum of warpage.

Why not call your nearest Nelson field engineer? He's an expert at reducing cost, and he'll be glad to assist you in analyzing your stud welding needs. Write for further information.

Stud Nelson

Fasten it Better at Less Cost with

NELWELD

NELSON STUD WELDING
2710 Toledo Avenue
Lorain, Ohio

Please send more information on heat exchanger studs and other cost-saving applications.

NAME _____

COMPANY _____

ADDRESS _____

CITY AND STATE _____

NELSON STUD WELDING DIV. OF [illegible] INDUSTRIES, INC. LORAIN, OHIO

NEW PRODUCTS and equipment

the automatic welding applications just described.

Argon, carbon dioxide and helium shielding gases and all kinds of welding wires (0.30-in. diam and up) can be used.

The head has a single motor drive and a continuous current rating of 600 amperes. *Write*: Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y. *Phone*: Murray Hill 2-6700 (Metal Show Booth 1750)

Carbon Control

This automatic instrument for controlled atmosphere heat treating has signal lights for high and low dew point indication. It controls the carbon potential of a heat treat furnace atmosphere.

The controller can be used for such processes as gas carburizing and clean hardening where a permanent record is not needed. *Write*: Surface Combustion Co., Toledo 1, O. *Phone*: Jordan 4611 (Metal Show Booth 304)

Light-Wall Tubing

Production limits for types 304 and 321 Weldrawn (welded and cold drawn) stainless tubing have been expanded to 2 1/16-in. OD.

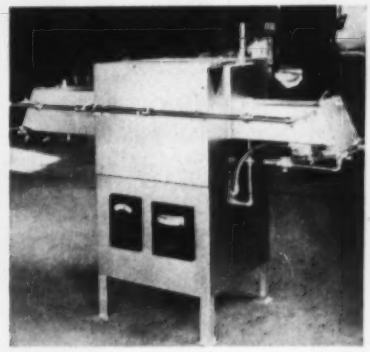
Two new carbon steel analyses are leaded C-1015 and C-1045. Leaded C-1015 has excellent machinability. It permits the use of tubing where leaded carbon steel bar stock has

been applied and complements the C-1118 analysis. The C-1045 is a medium carbon steel capable of a top hardness level of 50-55 Rockwell C in the quenched and tempered condition. *Write*: Superior Tube Co., Norristown, Pa. (Metal Show Booth 1470)

Sintering Furnace

Controlled atmosphere sintering of powdered metals (ferrous or nonferrous), brazing, bright annealing and many specialized applications in metallurgy and ceramics (cermets) are done by this furnace.

Products to be heat treated are placed on plates or trays and are pushed through the successive temperature zones by hand. Optional pusher systems have speeds as low as 0.03 ipm.



Heat losses are reduced to a minimum by adjusting the radiation baffles to conform to the size or type of product being treated.

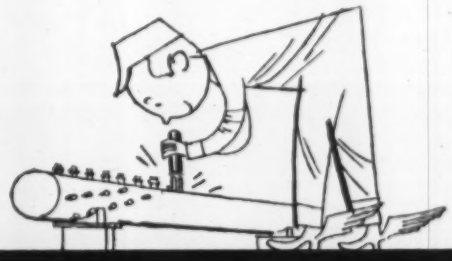
Counterbalanced doors have automatic flame curtains. Operating temperature is 2500°F or higher.

Maximum power rating is 20 kw, 220 v, single or 3 phase, 60 cycles. A 20-kva voltage regulating auto transformer is used. Large units are available. *Write*: Pereny Equipment Co., 893 Chambers Rd., Columbus 12, O. *Phone*: Axminster 9-8444

Long-Bed Lathe

This 11-in. machine has a 5-ft bed; its center to center distance is 36 in.

A unique drive selector is controlled by a single lever which makes possible a choice between

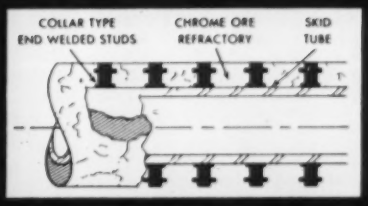


"STUD" NELSON END-WELDS

INSULATION STUDS IN A FLASH!

Encountering difficulty or high cost in securing or supporting insulation efficiently? If so, take a good look at the NELWELD® method.

NELSON® studs, end-welded in a split second, have solved hundreds of insulating problems for steel mills, all types of processing plants, and for manufacturers of boilers, heating and air conditioning equipment and tanks.



The NELSON collar stud, illustrated, is only one of many types that make insulating practical and profitable. Pins, hooks, rectangular studs, eye-bolts, split and slotted studs . . . fasteners for any kind of insulation . . . open up design possibilities without limit.

Your Nelson Field Engineer is a fastening expert, experience-trained to analyze your product designs at the blueprint stage . . . the point where remarkable savings can be realized. Write for details, indicating your problem.

Stud Nelson

Fasten it Better at Less Cost with

NELWELD®

NELSON STUD WELDING
2717 Toledo Avenue
Lorain, Ohio

Please send more information on securing insulation and other cost-saving NELWELD applications.

NAME _____

COMPANY _____

ADDRESS _____

CITY AND STATE _____

NELSON STUD WELDING DIV OF GREGORY INDUSTRIES, INC. LORAIN, OHIO

loose and locked spindle, direct or gear drive.

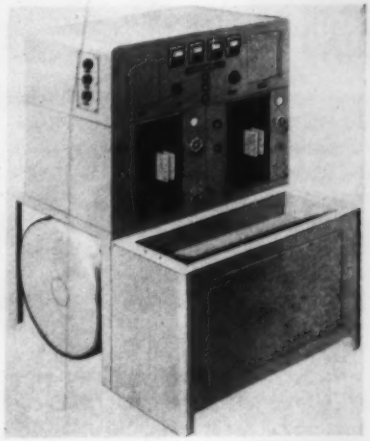
The variable-speed drive combines safety, convenience and infinite choice of speeds with the high-torque transmitting power of matched V-belts in the final drive. *Write*: Delta Power Tool Division, Rockwell Mfg. Co., 443 N. Lexington Ave., Pittsburgh 8, Pa. *Phone*: Churchill 1-8400 (Metal Show Booth 1530)

Induction Heating

This 30-kw "building block" unit can be combined and adapted to fit hardening and heat treating, metal-joining, hot-heading and forging operations.

The generator control cabinet contains the apparatus for control, instrumentation and protection of the high-frequency generator. A motor-generator set of 10,000 cycles is used.

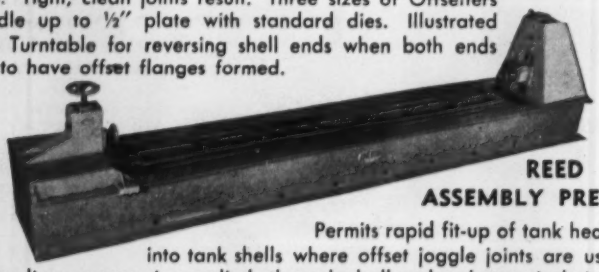
Dimensions of the unit are 48-in. wide, 59-in. deep and 77¾-in. high. *Write*: Westinghouse Electric Corp., P.O. Box 2099, Pittsburgh 30, Pa. *Phone*: Express 1-2800



WEBB TANK PRODUCTION MACHINERY

REED OFFSETTER

This machine forms an offset flange around shell ends to facilitate automatic welding of tank heads. It eliminates chill rings, decreases fit-up time, improves the concentricity of shell ends, and aids in reducing actual welding time. Tight, clean joints result. Three sizes of Offseiters handle up to ½" plate with standard dies. Illustrated with Turntable for reversing shell ends when both ends are to have offset flanges formed.



REED ASSEMBLY PRESS

Permits rapid fit-up of tank heads into tank shells where offset joggle joints are used. Hydraulic pressure is applied through ball-and-socket swivel joints that allow the head cups to set to the head. Hydraulically powered kick-outs speed up loading and unloading. Both headstock and tailstock are adjustable vertically; tailstock is also adjustable along the bed for various lengths of vessels up to 18'.

Fit-up rolls are also available to facilitate proper alignment and assembly of shells lacking rigidity.

Horn Type Fixtures | Cylinder Flange Offsetters | Assembly Fixtures | Unit Type Turning Rolls | Portable Turning Rolls | Automatic Welding Track Supports

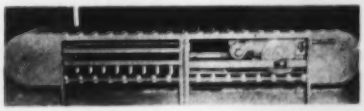
For Illustrated Literature—Write Dept. D

REED EQUIPMENT DIVISION
THE WEBB CORP. WEBB CITY, MO. U. S. A.

Steel Belt Conveyor

These variable speed conveyors can be built to almost any length, and in belt widths up to 60 in. They are made of cold finished steel sections which are continuously hinged with bolt pins.

Speeds range up to 100 fpm, capacities to 300 psf.



The drive section usually is about 5 ft long and is equipped with a high-torque, gear-in-head motor. Self-aligning ball bearing pillow blocks support the drive and idler shaft. Adjustable sprocket take-ups maintain proper belt tension. *Write*: West Bend Equipment Co., 343 Water St., West Bend, Wis. *Phone*: Federal 4-5561

Oils and Lubricants

Cutting Oil—This new product, Texaco B HD, combines the cost-saving benefits of heavy-duty black sulphurized cutting oils with the production advantages of a transparent material.

It can be used in almost all cutting, broaching and threading operations now using sulphurized black cutting oils. The operator can see the tool and the work surface while using the new oil. Its

Spring Steel

by SUPERIOR

for the

uniform behavior

you require

in fabrication!

in service!

Uniform, dependable response to your manufacturing processes and subsequent service requirements is outstanding in SUPERIOR Spring Steel. We build uniform behavior into every coil, from specified analysis of composition to final anneal before shipment. We're strip steel specialists: *you gain by it.* Specify SUPERIOR for your spring steel needs!

Superior Steel

CORPORATION

CARNEGIE, PENNSYLVANIA

"We ought to label this box LOST PROFITS"

Why? Because you lose the original labor cost when any part has to be reworked. Such loss usually exceeds the manufacturing profit. Is "rework" eating into your profits — unnecessarily?

Why accept rework loss? . . . You don't have to accept this loss as "fixed". The point in production where you spot cracks or defects determines whether you lose both time and labor.

Inspection with Magnaflux during manufacture finds *all* cracks when they first occur suggests the cause and how it can be corrected — *before* parts are run in quantity. Magnaflux keeps cracked parts from being machined, holds rework at minimum, reduces loss.

Cracks, whatever the cause, whether from heat treating, grinding . . . cleaning, or handling,— all run up your labor costs if you don't find them early enough.

Inspection with Magnflux is extremely low in cost, and is fast. Ask to have one of our engineers help you investigate how inspection with Magnaflux may save you money — or write for new booklet on LOWER MANUFACTURING COST.

MAGNAFLUX CORPORATION

7312 West Lawrence Avenue • Chicago 31, Illinois

New York 36 • Pittsburgh 36 • Cleveland 15 • Detroit 11 • Dallas 19 • Los Angeles 58

MAGNAFLUX

extreme pressure properties give more production between tool grinds.

Emulsive Coolant—This soluble oil, HD, carries off heat effectively while operating under severe work conditions. It reduces processing costs of a wide range of cutting, boring and broaching operations.

The oil is easy to handle and prepare for production runs. It mixes well with hard or soft temperate water and makes a highly stable emulsion. Rust inhibiting properties are excellent.

On many operations, it can replace a cutting oil. It eliminates smoke and helps prevent tool breakage.

Drawing Compound—Savings in time and labor, increased die life and reduced unit costs are given by Texaco drawing compound 2.

The new compound (it replaces one of the same name) incorporates a dispersion agent that retards the settling out of nonabrasive pigment.

The compound allows dies to be stored for long periods without danger of the compound caking or hardening. Dies can be stored after a production run without danger of rusting. The material adheres strongly to all surfaces and is water miscible.

The compound spreads easily on die, punch and blank surfaces, so that the metal being formed does not come in contact with the forming surfaces. *Write*: The Texas Co., 135 E. 42nd St., New York 17, N. Y. *Phone*: Murray Hill 9-7700 (Metal Show Booth 734)

Wire Thread Insert

Here is a new type insert that can be installed without cutting threads in the parent material. It's for use with plastics, laminates, wood and soft metals. It also can be placed in the die or mold of a cast or extruded part with mold or die pins to form strong, permanent, stainless steel threads when the part is made. *Write*: Heli-Coil Corp., Danbury, Conn. *Phone*: Pioneer 3-3851 (Metal Show Booth 617)

Quenching Oil

Fast cooling rates and high oxidation stability are given by this new oil. Its flash point is 380°F, its fire point, 425°F.

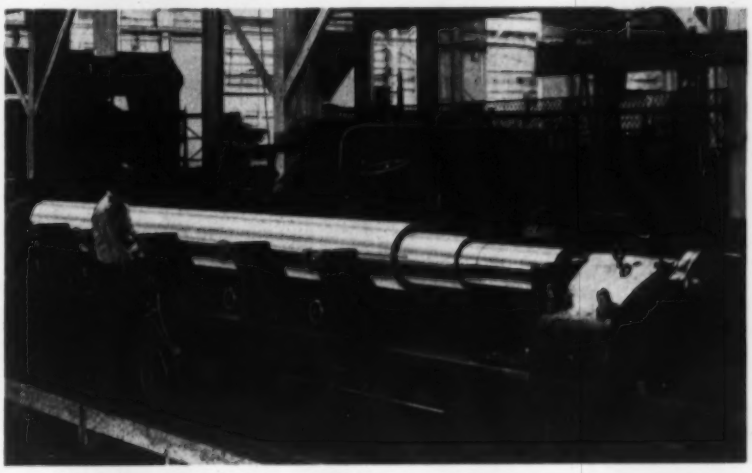
In many cases the new oil can quench low carbon or low alloy steels, where formerly water was necessary.

The oil has high water tolerance, low volatility and drains off hardened parts easily. *Write*: Shell Oil Co., 50 W. 50th St., New York 20. N. Y. *Phone*: Judson 6-5000

Indexing Machine

This special double-end trunnion machine processes 120 transmission plates an hour. It drills, chamfers and taps all mounting holes; it rough bores, finish bores and

STEEL MILL ROLLS
by
TITUSVILLE FORGE



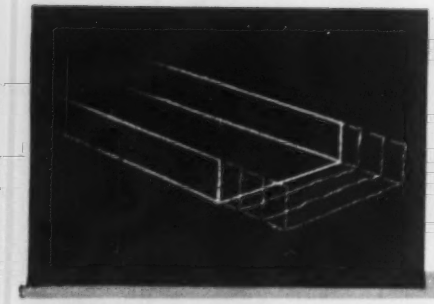
ALL TYPES AND SIZES FORGED AND GROUND TO YOUR SPECIFICATIONS

Plate rolls—bending rolls—back up rolls—straightening rolls—table rollers and other mill rolls are dependably forged and ground in any size—to any specification at Titusville Forge. Illustrated above is a straightening roll being ground on our 42" Landis Grinder. Size is 16" diameter x 28'3½" long, 40/45 scleriscope hardness.

Rely on Titusville Forge for mill rolls that meet your specific requirements.

Struthers Wells

STRUTHERS WELLS CORPORATION
TITUSVILLE FORGE DIVISION
TITUSVILLE, PA.
PLANTS AT TITUSVILLE, PA., and WARREN, PA.
Offices in Principal Cities



HOLCROFT and the SHAKER HEARTH FURNACE

Volume Production of SMALL PARTS

Controlled atmospheres—heating—fuel economies—stock handling. All these are factors to consider when you are trying to determine which heat treat furnace to select.

Take stock handling, for example. You might well consider a shaker hearth furnace if you are a volume producer of small parts such as screw machine production or stampings. It's continuous—a type of stock handling that's geared to production flow—and a type that eliminates the possibility of a bottleneck in the heat treat department.

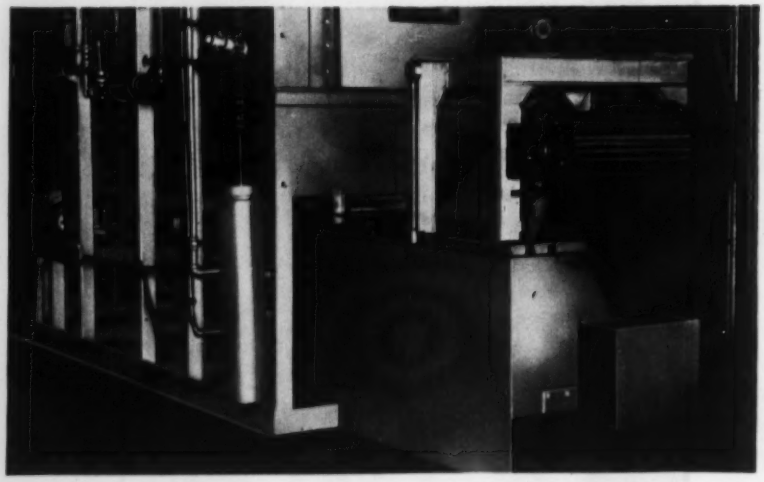
The work is either manually or automatically placed directly on a hearth which is designed to move forward quickly a few inches, stop suddenly, and then return to its original position. The sudden jolt slides the parts through the furnace. An alternate arrangement is set up so that the hearth moves forward slowly, halts, then snaps back to its original position. Either method assures uniform heat treatment of each individual part.

You can get engineering information—honest appraisals of your problem—if you consult Holcroft when you are planning expansion. The result is bound to be a heat treat facility *balanced* to your production requirements. It will cost you less in the long run! Write today for complete information!

Holcroft & Company, 6545 Epworth Blvd., Detroit 10, Michigan.

BUILT BY HOLCROFT & COMPANY DETROIT MICH. PRODUCTION HEAT TREAT FURNACES FOR EVERY PURPOSE

CHICAGO, ILL. CLEVELAND, OHIO DARIEN, CONN.
HOUSTON, TEXAS LOS ANGELES, CALIF. PHILADELPHIA, PA.
CANADA: Walker Metal Products, Ltd., Windsor, Ontario



NEW PRODUCTS and equipment

chamfers the starter hole.

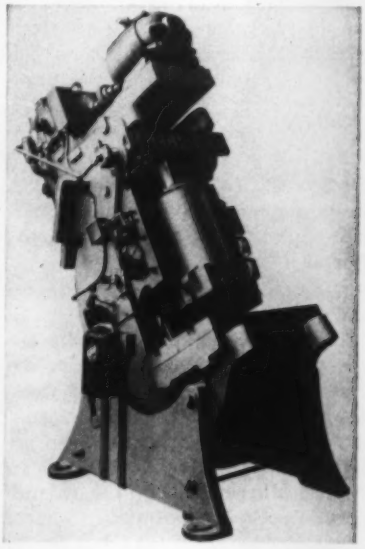
Long stroke units allow the heads to be retracted from the trunnion for quick change-over of tools. Power cylinders automatically clamp the parts.

The machine has a central coolant system; all chips drop through the center of the unit to a conveyor. *Write*: Michigan Drill Head Co., P. O. Box 4643, Detroit 34, Mich. *Phone*: Jefferson 9-4200

Die Tryout Press

Here is a new hydraulic press for die tryout and pilot production runs. It combines the best features of hydraulic action and gap frame construction.

Precise control over inching permits close observation of die action. Full tonnage is available at any point in the stroke.



A long stroke compensates for die space and press setup adjustments.

Models are available in capacities from 50 to 250 tons. *Write*: E. W. Bliss Co., Canton, O. *Phone*: 7-3421

Chemical Neutralizer

Here is a product that enhances the appearance and salability of neutralized steel sheet. Providing a rust protective surface, the product, Detrex CX, eliminates the use

ACCO products

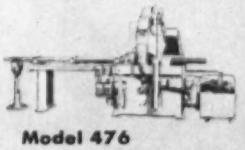
Campbell Abrasive Cut-off Machines

There is a CAMPBELL Abrasive Cut-Off Machine to handle ALL SIZES of high-alloy steel—quicker, cleaner, and more economically

Model 2
Hand-operated submerged cutting machine with 4" diam. capacity.

Model 15
Hand-operated wet or dry machine. Max. cap. 1" diam. solid, 2" tubing.

Model 223
Hand-operated bar cutting machine. Cap. 2" diam. solid, 4" tubing.

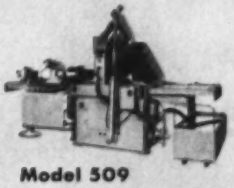


Model 476
Wet abrasive cutting machine with capacity to cut 6" diam. solids.

Model 265
Hydraulically-operated with capacity to cut 2" diam. solid, 4" tubing.

Model 480
For wet abrasive cutting stock to 8" diam. solids.

Model 302
Horizontal wet abrasive cutting machine for flat or irregular shapes.



Model 509
Rotary-oscillating-hydraulic wet abrasive machine. Cuts tubing to 9" diam.

Model 406
High-speed machine with capacity to cut 6" diam. solids in seconds.

Check these CAMPBELL Features

- Quality cuts—free from surface hardening
- Cut-off lengths held to close tolerances
- Cuts exceptionally smooth and burr-free
- Subsequent milling or grinding eliminated
- Accuracy of abrasive cutting reduces scrap loss
- Quick, accurate cutting brings high production
- CAMPBELL Engineers will run tests for you

Send for DH-301 "Principles of Abrasive Cutting"
Find out what a CAMPBELL Abrasive Cutter can do for you

Visit Booth 1420 National Metal Exposition
Philadelphia—October 17-21

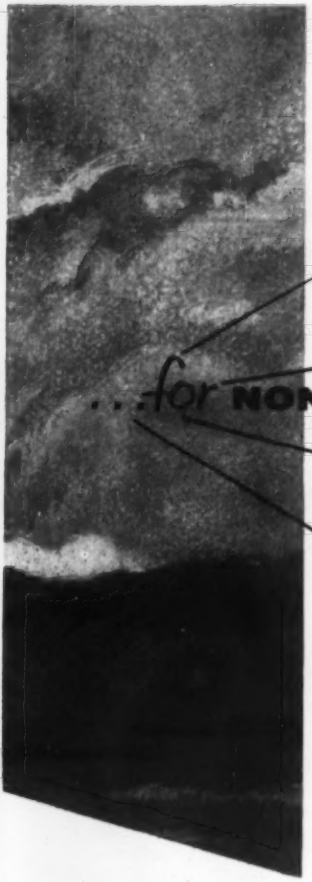
ACCO

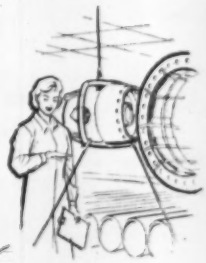
Campbell Machine Division
AMERICAN CHAIN & CABLE

925 Connecticut Avenue, Bridgeport 2, Connecticut

Better Value

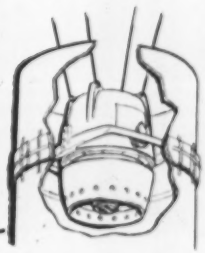
presents
the KEL-RAY® Projector*
A safe, versatile tool for
Radiography with gamma rays . . .
2196
® Trade Mark of The M. W. Kellogg Company
* Sold exclusively by Metal & Thermit Corporation. Designed and manufactured by The M. W. Kellogg Company.





SAFE

KEL-RAY projectors have extremely low radiation leakage. . . so low they can be shipped and stored without additional shielding. They are tamper, fire, and shock proof. Operated under prescribed procedures, leakage is below the AEC limit.



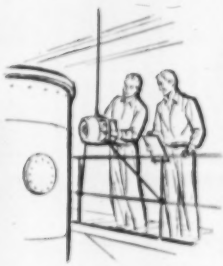
VERSATILE

A single set-up can produce either spot, doughnut, or hemisphere panoramic radiographs. Thick steel sections can be radiographed; sensitivity is so great even incandescent lamp filaments have been radiographed with a KEL-RAY projector.

. . . for NON-DESTRUCTIVE INSPECTION and TESTING

CONVENIENT

Designed for field or shop use, the smallest model can be carried by hand—largest is transported and positioned speedily with standard equipment for materials handling and rigging.



ECONOMICAL

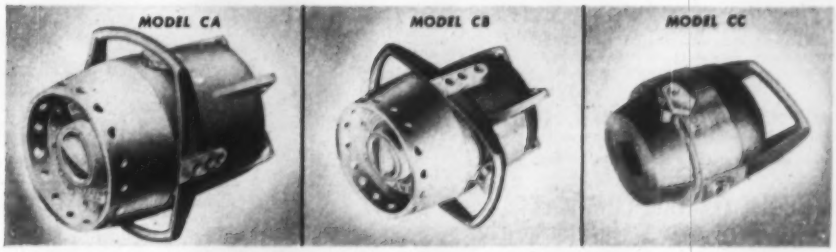
Initial and operating costs are low. No delicate parts to pamper or adjust . . . no expensive electrical power source required. Minimized overall set up and exposure time provide further savings.

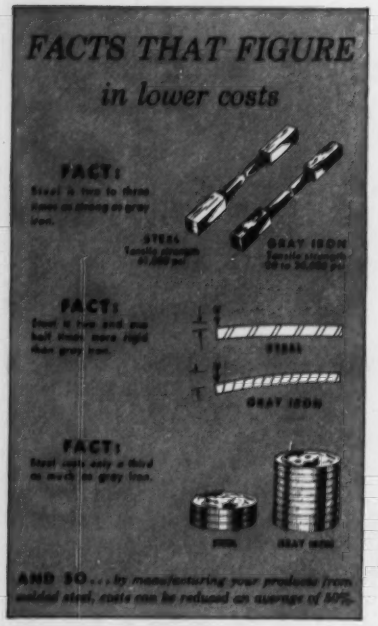
The KEL-RAY line of gamma ray projectors is a development inspired by industry's need for truly safe, portable radiographic equipment. Now it is possible to do faster, more economical, non-destructive testing in field or factory.

Depending on the projector model and service requirements either encapsulated Cobalt 60, Cesium 137 or Iridium 192 is used as the gamma ray source. When the radioisotope is moved to the operating position, the projector emits an intense, sharply defined beam of gamma rays that pass through the solid subject to expose the film positioned behind.

Each of the three KEL-RAY Projector models is a portable, powerful, shielded, self-contained source of penetrating radiation for non-destructive inspection in maintenance, construction or quality control. There is a KEL-RAY Gamma Ray Projector that can improve your operations—save you time and money! Write for detailed literature.

METAL & THERMIT
CORPORATION
100 EAST 42nd STREET • NEW YORK 17, N. Y.





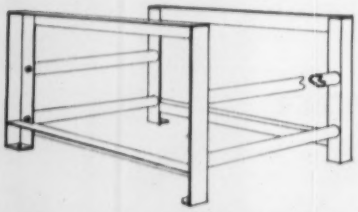
HOW WELDED STEEL BUILDS STRONGER PRODUCTS

... for lower cost

BY using welded steel design, material costs can be reduced up to 86% compared to using gray iron.

The amount of saving depends on how well the design utilizes steel's superior strength and rigidity.

The substantial saving in material cost leaves a wide margin in which to fabricate the steel by welding and still realize overall savings of 50% on many types of products.



Costs 23% Less. *Base for machine weighs 50% less than former casting construction, is stronger, more rigid, neater in appearance. Fabricated in only 6 hours . . . former design took 14 hours.*

How to design in steel

Handbook and bulletins on welded design are available to designers and engineers by writing:

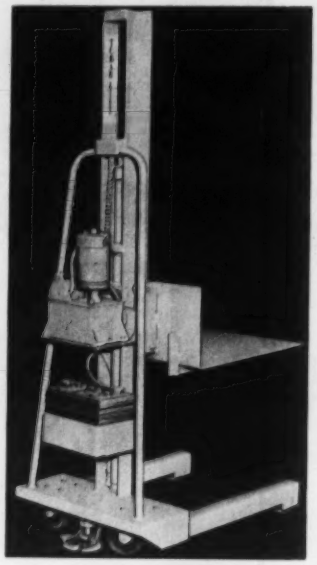
THE LINCOLN ELECTRIC COMPANY
Dept. 1610
Cleveland 17, Ohio
THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

NEW PRODUCTS and equipment

of cyanides, lime and other alkaline neutralizers. *Write*: Detrex Corp., Box 501, Roosevelt Park Annex, Detroit 32, Mich. *Phone*: Townsend 8-8600 (Metal Show Booth 1205)

Hydraulic Stacker

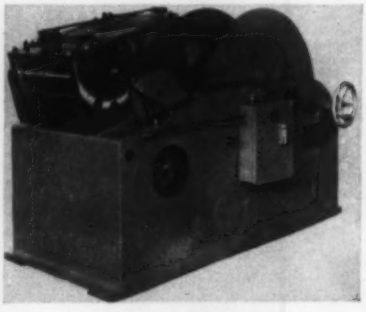
This lightweight stacker handles up to 500 lb. A positive floor lock gives safety and stability.

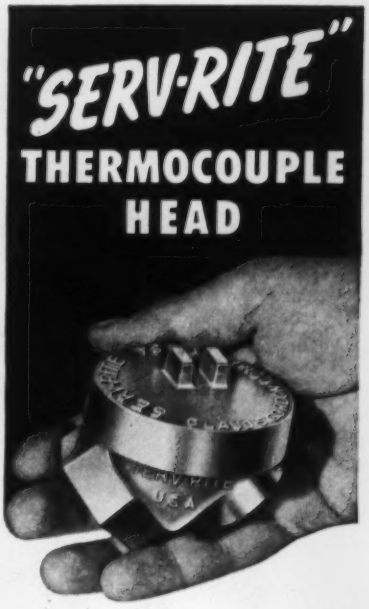


The main frame is of welded construction. Wheels are mounted inside the main-frame channels for better clearance. Lifting height is 60 in.; lowered platform height is 5 in. The platform is 20 x 24 in. *Write*: Uhrden Inc., P.O. Box 51, Dennison, O.

Coil Straightener

This combination cradle and straightener handles coils up to 36-in. wide, 60-in. in diameter,





the head that's ahead in every way . . .

This new "Serv-Rite" thermocouple head is actually small enough to be held comfortably in the palm of your hand. But size is only one of the many features that make this thermocouple head really extraordinary. It is loaded with installation and service conveniences that any user of thermocouples will appreciate at once.

The body is of malleable iron, cadmium plated for durability. A new type friction lock assures easy removal or tightening of the cap — a quarter turn does it. An asbestos gasket makes the head dirt- and moisture-proof. With a choice of ½", ¾", or 1" IPS opening for the protecting tube, you can standardize on one style head.

The connector block is of a material especially selected to withstand, without damage, temperatures up to 900° F. in continuous service. Improvements over the conventional type of inserts greatly simplify the making of the lead wire connections. The complete thermocouple element, including connector block, can be easily withdrawn for inspection.

Install a "Serv-Rite" thermocouple head and see for yourself how much better it really is.

Write for complete details

4421

GORDON SERVICE

CLAUD S. GORDON CO.

Manufacturers • Engineers • Distributors

Thermocouples & Accessories • Temperature Control Instruments • Industrial Furnaces & Ovens Metallurgical Testing Machines

617 West 30th Street, Chicago 16, Illinois
2017 Hamilton Avenue, Cleveland 14, Ohio

A Natural for Stainless...

HOW GOOD PRODUCTS CAN BE MADE BETTER WITH THE RIGHT STAINLESS FROM THE

HOUSE OF STAINLESS

THE NEED

In fabricating their "Bake-Rite" ovens, the Hubbard Oven Company found that in normal service the material used for the front panels in their general line was subject to chipping, corrosion and discoloration.

THE ANSWER

Here was another situation that indicated the need for the properties inherent in stainless steel. With this in mind, Hubbard engineers turned to the House of Stainless for the answer. The stainless steel recommended by CSS metallurgists has eliminated these problems while enhancing the attractive appearance of the product.

With more than 30 different types of stainless steel, it is just sound business to consult the House of Stainless for the stainless that can *best* meet your individual requirements.

CSS specialists will recommend the *right* stainless for your product, and then go all out to supply your needs from warehouse stocks or mill shipments through our mill placement department.

Just phone LAfayette 3-7210

Photo, courtesy of Hubbard Oven Company, Hampshire, Illinois

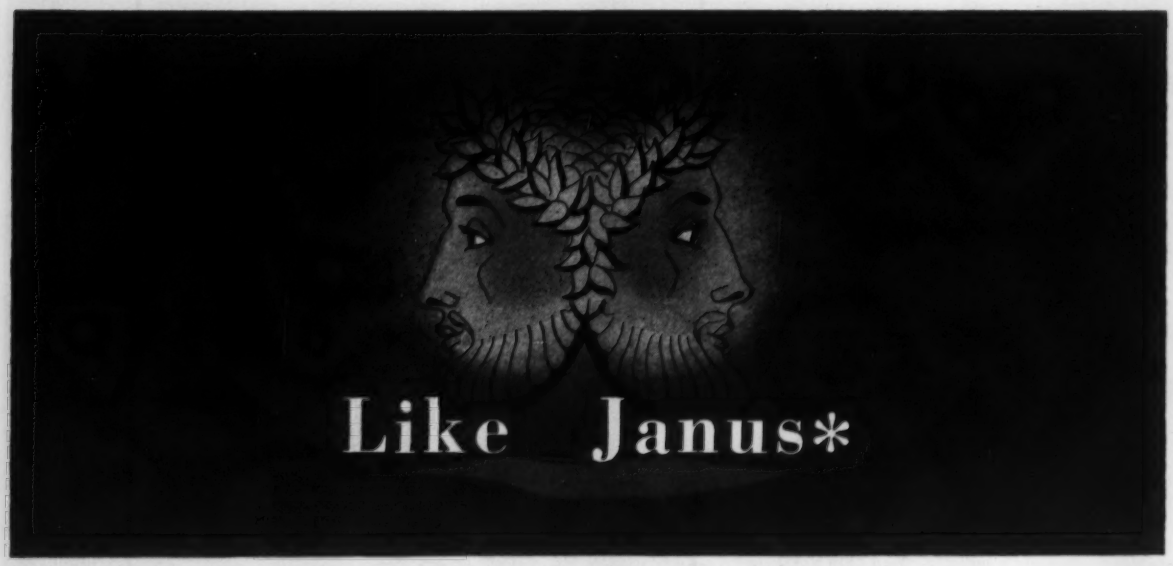
The House of Stainless — CSSI AT YOUR SERVICE JILLL

CHICAGO STEEL SERVICE COMPANY

Kildare Avenue at 45th Street, Chicago 32, Illinois
Mailing Address: P.O. Box 6308, Chicago 80, Illinois

Milwaukee District Office: 757 North Broadway, Milwaukee 2, Wisc. Telephone BRoadway 3-7874
Minneapolis District Office: 3501 Hennepin Avenue, Minneapolis 8, Minn. Telephone COlfax 2602

Sales Representative at Bloomington and Rockford, Illinois; Indianapolis and South Bend, Indiana; Cedar Rapids and Bettendorf, Iowa; Grand Rapids, Michigan; Appleton, Wisconsin.



Baker's Magdolite

looks back with pride . . . and forward with confidence

Reviewing the past, The J. E. Baker Company is proud of the part it has played in the astounding growth of the steel industry. Since 1889 the JEBCO name has stood for superior products. One of these products, BAKER'S MAGDOLITE the *original* dead-burned dolomite, was the result of continuous research and experimentation to find a far better basic lining for open hearth and electric furnaces. Today as in the past, BAKER'S MAGDOLITE offers increased furnace efficiency at lower refractory costs.

In the future, users of BAKER'S MAGDOLITE can be assured of constantly improved quality and effectiveness, in keeping with the tremendous strides foreseen in increased steel production.

If you haven't done so in the past, be sure to try BAKER'S MAGDOLITE in the near future. You'll discover as others have through the years that the properly burned, grain-sized particles of BAKER'S MAGDOLITE mean more uniform ingots, in greater numbers and with less defective material. Next time specify BAKER'S MAGDOLITE.

JEBCO
PRODUCTS
SINCE 1889

*Janus, the two-faced mythological Roman God of Doors and Gates, could see both what passed behind and before him at the same time.

THE J. E. BAKER COMPANY

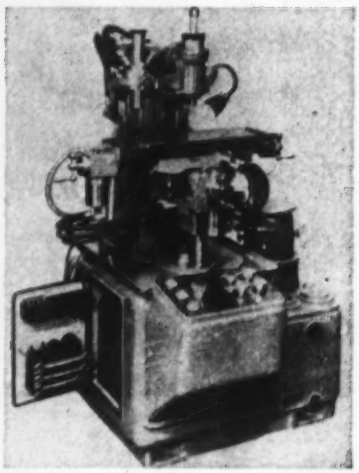
YORK, PENNSYLVANIA • PLANTS: BILLMEYER, YORK, PENNSYLVANIA • MILLERSVILLE, OHIO

weighing 20,000 lb. The rate of stock delivery is adjustable to speed requirements.

Rotating side plates prevent the crimping or damaging of stock ends. Stock up to 3/16-in. thick can be handled. *Write*: Special Engineering Service Inc., 8161 Livernois, Detroit 4, Mich. *Phone*: Texas 4-8700

Profile Milling Machine

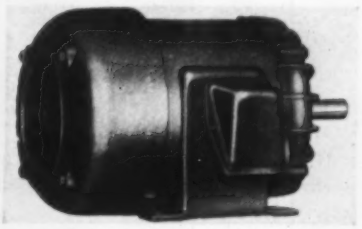
Fully automatic, this machine is used for three-dimensional copy milling of dies, rubber and glass molds, turbine blades and all workpieces of irregular shape. Highly skilled operators are not necessary.



Crossfeeds are variable from 0.005 to 0.250 in. Cutters up to ½-in. in diameter can be used. *Write*: Wickman Products Corp., 10325 Capital Ave., Oak Park, Detroit 37, Mich. *Phone*: Jordan 4-6389

Enclosed Motors

In production is a new line of rerated fan-cooled motors— 1 to 5 hp. The motor has an aluminum rotor. A ventilating fan provides efficient operation in either direction. All new NEMA require-



AIR LIFT
for heavy materials

Crowded isles and sluggish flow of materials cost you money. So why not go over the top! You can speed production, cut your costs with Conco Cranes, custom designed for your specific needs. Let us show you how. Write for a trained Conco engineer to call and make recommendations, or request bulletin 3000A covering our complete Conco line. Conco Cranes are backed by 37 years of experience.

CONCO ENGINEERING WORKS
Division of H. D. CONKEY & COMPANY
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CRANES HOISTS CONCO

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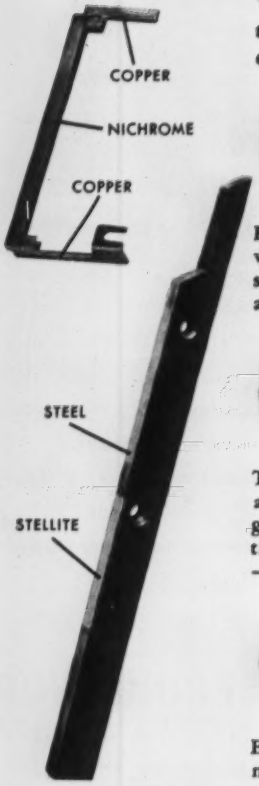
CONCO ENGINEERING WORKS—Domestic Heating Equipment
CONCO BUILDING PRODUCTS, INC.—Brick, Tile, Stone

The amazing **VERSATILITY** of EASY-FLO and SIL-FOS

You'd have to go a long way to find a brazing job that these low-temperature silver brazing alloys can't do.



VERSATILITY IN METALS

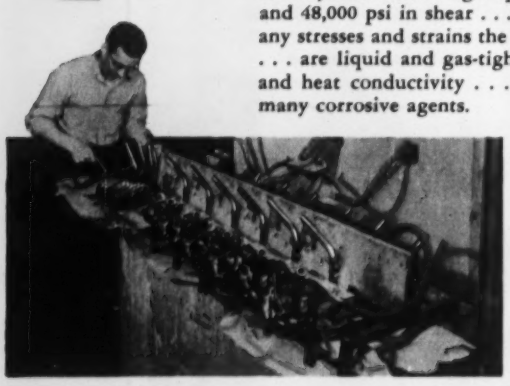
Between them, the EASY-FLO and SIL-FOS alloys will join practically all ferrous, non-ferrous and dissimilar metals and alloys that have melting points above the alloys' respective flow points.

VERSATILITY IN HEATING METHODS

The EASY-FLO and SIL-FOS alloys work well with all . . . oxyacetylene, natural and city gas torches — gas-air burners — oil, gas and electric furnaces — electric induction, resistance or incandescent carbon — molten alloy or salt dip . . . take your pick.

VERSATILITY IN JOINTS

EASY-FLO and SIL-FOS naturally and consistently make joints that . . . go up to 130,000 psi in tension and 48,000 psi in shear . . . have the ductility to take any stresses and strains the metals they join can stand . . . are liquid and gas-tight . . . have high electrical and heat conductivity . . . offer strong resistance to many corrosive agents.



In the job shown here induction heating is used to braze steel handle bars to stems with EASY-FLO 35 — 6 at a time in 32 secs. The two jobs shown at left above are gas torch brazed with EASY-FLO 45.

ADD to their 3-ply versatility the fact that their low flow points protect metals and save gobs of time, labor and heat — and you have every reason to standardize on the EASY-FLO and SIL-FOS alloys for all your brazing.

GET THE FULL STORY IN BULLETIN 20

It's full of useable ideas. Write for a copy today.

HANDY & HARMAN

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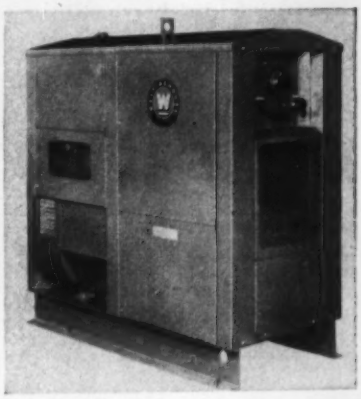
There's no ". . . or equal" for EASY-FLO and SIL-FOS

NEW PRODUCTS and equipment

ments are met. *Write*: Century Electric Co., 1806 Pine St., St. Louis, Mo. *Phone*: Central 1-4920

Welders

Here is a new line of gasoline-engine-driven, generator-type welders available in current ranges of 30 to 350 amp, alternating or direct current.



All models have infinite current adjustment steps. They are compact, completely self-powered and may be equipped with optional running gear. *Write*: Westinghouse Electric Co., P. O. Box 2099, Pittsburgh 30, Pa. *Phone*: Express 1-2800

Welding Positioner

Here is a mechanical support for the automatic welding of cylindrical parts. Its capacity: 2500 lb.

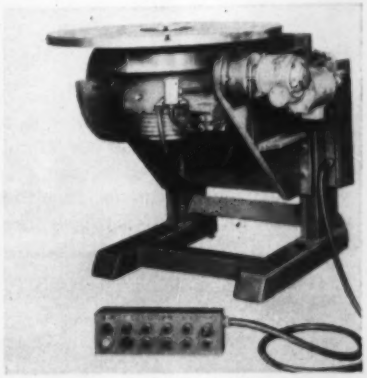
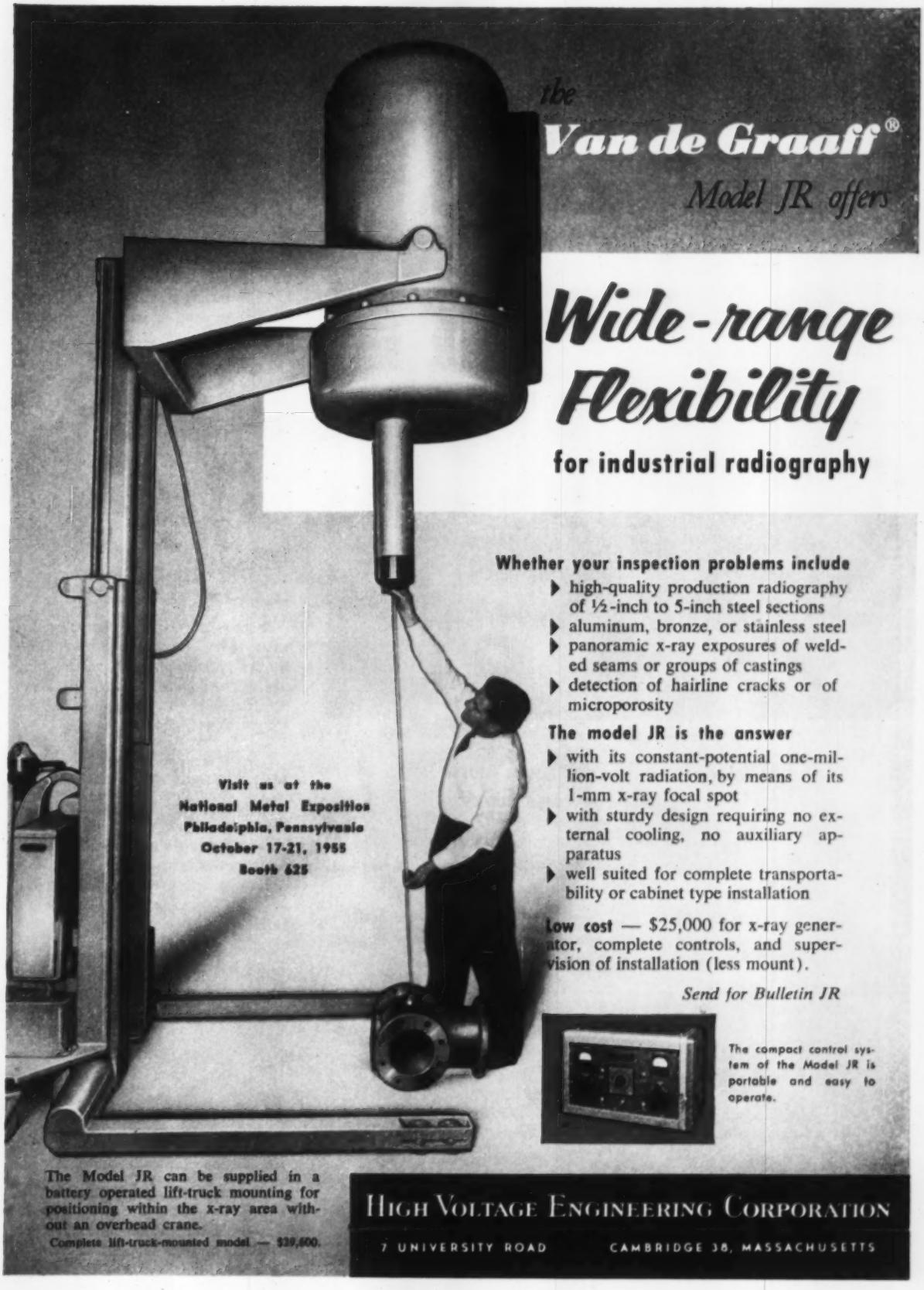


Table tilt is 135 degrees; rotation is 360 degrees. The hollow center table has a 9-in. ID and a



the
Van de Graaff®
Model JR offers

Wide-range Flexibility

for industrial radiography

Whether your inspection problems include

- high-quality production radiography of ½-inch to 5-inch steel sections
- aluminum, bronze, or stainless steel
- panoramic x-ray exposures of welded seams or groups of castings
- detection of hairline cracks or of microporosity

The model JR is the answer

- with its constant-potential one-million-volt radiation, by means of its 1-mm x-ray focal spot
- with sturdy design requiring no external cooling, no auxiliary apparatus
- well suited for complete transportability or cabinet type installation

Low cost — $25,000 for x-ray generator, complete controls, and supervision of installation (less mount).

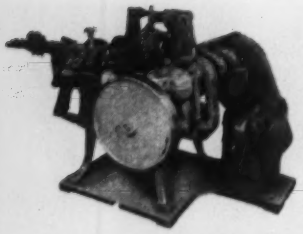
Send for Bulletin JR

Visit us at the
National Metal Exposition
Philadelphia, Pennsylvania
October 17-21, 1955
Booth 625

The compact control system of the Model JR is portable and easy to operate.

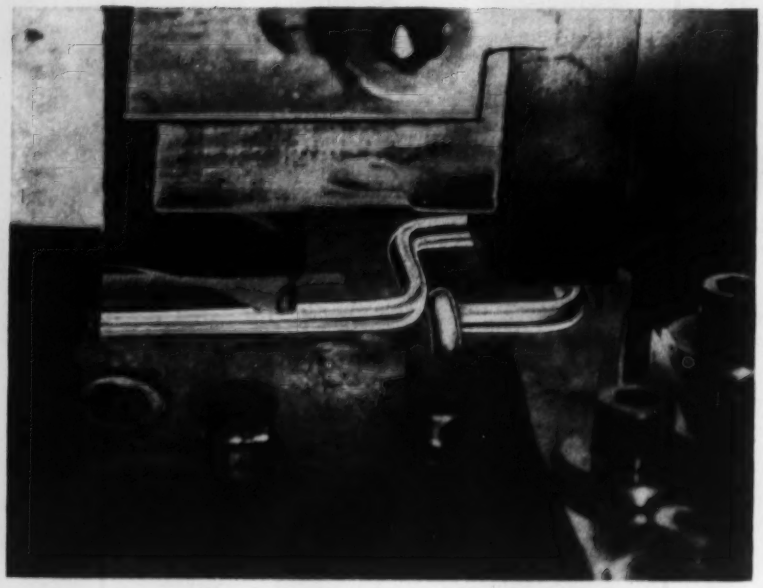
The Model JR can be supplied in a battery operated lift-truck mounting for positioning within the x-ray area without an overhead crane.
Complete lift-truck-mounted model — $39,600.

HIGH VOLTAGE ENGINEERING CORPORATION
7 UNIVERSITY ROAD CAMBRIDGE 38, MASSACHUSETTS



NILSON 4-SLIDES PAY OFF 4 WAYS

• BIG PROFITS • BIG PRODUCTION
• BIG SAVINGS • BIG GAIN IN ACCURACY



Forming Operation: Meter Shunts of 3/16" Wire Stock

WHY NILSON IS TOPS FOR 4-SLIDES:

Nilson 4-Slides are built for rugged duty
Form both ribbon metal and wire stock
Press capacities 8 to 75 tons, wire diameter to ½"

16 Models Available, Including Combinations of Horizontal Press and 4-Slide

YOU PROFIT BY: Automatic Operation • Increased Production • No Secondary Handling • Improved Products • Fewer Rejects • Lowest Initial Cost

Nilson engineers are always available for consultation on forming problems. Bulletin #61 sent on request.

Nilson's 3 tilt and 3 stationary reels handle wire or ribbon stock coils up to 500 pounds.

A.H. NILSON MACHINE COMPANY

1512 RAILROAD AVENUE, BRIDGEPORT 5, CONN.

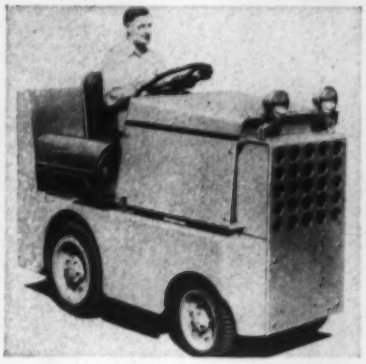
Automatic Chain Making Machines • Staple Forming Machines • Wire and Stock Reels • Wire Straightening Equipment • Slide Feeds for Presses • Wire and Ribbon Stock Forming Machines

NEW PRODUCTS and equipment

40-in. OD. Maximum table speed is 2 rpm; minimum is 0.1 rpm. *Write*: Sciaky Bros. Inc., 4915 W. 67th St., Chicago, Ill. *Phone*: Portsmouth 7-5600

LP Gas Tractor

Extra long life and lower maintenance costs are the claims for this liquid petroleum gas tractor. LP gas burns completely; it leaves no carbon, lead or varnish deposits.

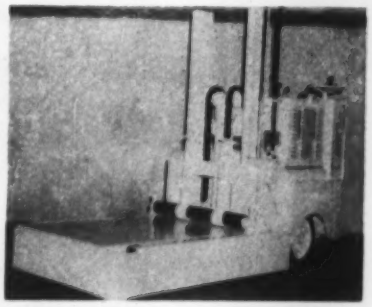


Increased engine compression ratios give maximum power. Stellite valves and inserts assure long life. *Write*: Mercury Mfg. Co., 4044 S. Halsted St., Chicago 9, Ill. *Phone*: Yards 7-2515

Die Handling Truck

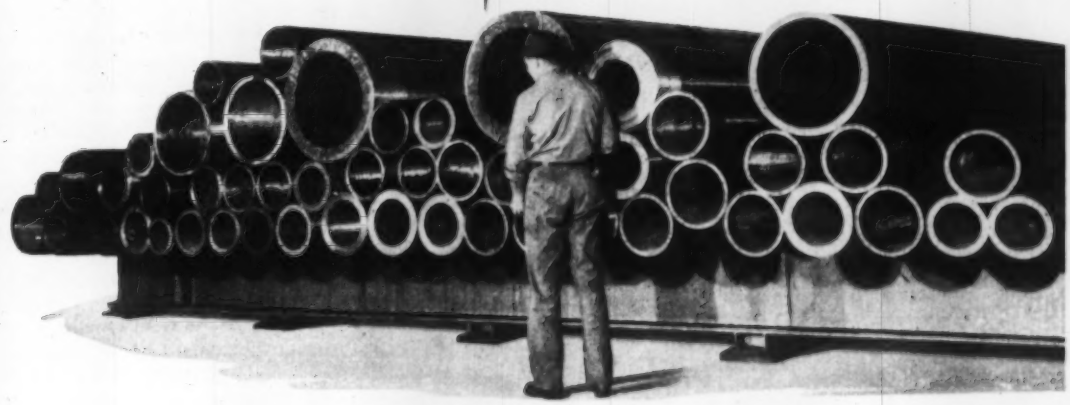
Capacity of this hydraulically controlled truck is 16,000 lb. It is 152 in. long; its width is 60 in. The platform is 66 x 60 in.

Low position of the platform is 17½-in. from the floor, top height is 74 in.



Three types of power units are available—battery, gas-electric and diesel-electric. *Write*: Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland 3, O. *Phone*: Utah 1-6200

B&W Offers
HOLLOW FORGINGS in A Wide Range of Sizes



B&W Hollow Forgings are produced in a large range of fractional inch sizes and a selected range of standard pipe sizes in accordance with the following ASTM Specifications: A 106-52T seamless carbon steel pipe for high-temperature service. A 266-54 carbon steel seamless drum forgings. A 312-54T seamless and welded austenitic stainless steel pipe. A 335-53T seamless ferritic alloy steel pipe for high-temperature service. A 376-54T seamless austenitic steel pipe for high-temperature central-station service.

Carbon Steel and Intermediate Alloys

Outside Diameter: 9¼ inches to 35¾ inches
Wall Thickness: ¾ inch to 5⅝ inches

STANDARD PIPE SIZES
AVAILABLE AS HOLLOW FORGINGS

Size Inches	Nom. OD Inches	Schedule Nos.
10	10¾	120–140–160
12	12¾	100–120–140–160
14	14	100–120–140–160
16	16	80–100–120–140–160
18	18	100–120–140–160
20	20	100–120–140–160
24	24	100–120–140–160

These pipe sizes are in complete agreement with ASA standard No. B36.10-1950.

Austenitic Stainless Steels

Outside Diameter: 9¼ inches to 33¾ inches
Wall Thickness: ½ inch to 4½ inches

MINIMUM WALL EQUIVALENTS OF
STANDARD PIPE SIZES AVAILABLE
AS STAINLESS STEEL HOLLOW FORGINGS

Size Inches	Nom. OD Inches	Schedule Nos.
10	10¾	80–100–120–140–160
12	12¾	60–80–100–120–140–160
14	14	60–80–100–120–140–160
16	16	60–80–100–120–140–160
18	18	80–100–120–140–160
20	20	100–120–140–160
24	24	100–120–140–160

For the complete range of B&W Hollow Forgings plus other important information on what B&W has to offer you in Hollow Forgings, send for Bulletin S-16B. The Babcock & Wilcox Company, Process Equipment Department, Barberton, Ohio.

BABCOCK & WILCOX

BOILER DIVISION

S-446

When welding stainless...and corrosion resistance is a "must"

WELD WITH ARCOS

STAINLESS ELECTRODES

Welds on a catalytic cracking unit such as this are continually subjected to corrosion, pressure and high temperatures. They must be perfect—faulty welds will result in failure and costly downtime. That's why it pays to specify ARCOS Stainless Electrodes. Quality controlled in manufacture, they assure sound weld metal for long-term dependability under continual use and the severest conditions. ARCOS CORPORATION, 1500 South 50th Street, Philadelphia 43, Pa.

NEW Literature

Write directly to the company for a copy

Drive Selection

Tables and data make selection of constant-speed, V-belt drives easy—bulletin 20P40, 74 pages. Allis-Chalmers Mfg. Co., 1021 S. 70th St., Milwaukee, Wis.

Refractories

Performance data and specifications are presented for brick and special shapes—24 pages. Mullite Refractories Co., Shelton, Conn.

Springs

Directions for specifying springs are given—8 pages. Automatic Spring Coiling Co., 4025 W. Thorndale Ave., Chicago 30, Ill.

Diamond Abrasive

Advantages of diamond abrasive for rough grinding and final polishing are given—diamond series booklet 2, 8 pages. Abrasives Division, Elgin National Watch Co., Elgin, Ill.

Gear Grinding

A complete line of new, fully automatic gear grinding machines is described—8 pages. Gear Grinding Machine Co., 3901 Christopher, Detroit 11, Mich.

Titanium

Properties and methods of fabricating titanium are given—8 pages. Pigments Dept., E. I. du Pont de Nemours & Co. Inc., Wilmington, Del.

Hydraulic Presses

Here is information on double-action presses in 50 to 300-ton capacities—40 pages. Clifton Hydraulic Press Co., 284-292 Allwood Rd., Clifton, N. J.

Refractories

Here are tables on hydraulic-setting refractories for service through 3000°F—12 pages. Johns-Manville, 22 E. 40th St., New York 16, N. Y.

Steel Shelving

Here is help in selection of shelving—catalog FF 188, 44 pages. Remington Rand Division, Sperry Rand Corp., 315 Fourth Ave., New York 10, N. Y.

Solder for Aluminum

Bulletin tells how to use alloys and fluxes for soldering, brazing and

welding aluminum and its alloys. All-State Welding Alloys Co. Inc., 249-55 Ferris Ave., White Plains, N. Y.

Floor Drills

Features of 21-in. sliding head drills are illustrated—catalog D-140, 8 pages. Installation and operation are covered—catalog D-141, 36 pages. Cincinnati Lathe & Tool Co., Cincinnati 9, O.

Cold-Drawn Tubing

Electricwelded tube, its applications and specifications are given—4 pages. Electricweld Tube Division, Jones & Laughlin Steel Corp., Pittsburgh 30, Pa.

Hole Cutter

Described is a tool that cuts holes in steel and brass. Erwood Inc., 1770 W. Berteau Ave., Chicago 13, Ill.

Punch Presses

Illustrations show uses of open throat presses—20 pages. Diamond Machine Tool Co., 5111 Coffman-Pico Rd., Pico, Calif.

Sling Handbook

Splicing, rated loads and ways to use slings are covered—64 pages. Union Wire Rope Corp., 2100 Manchester Ave., Kansas City, Mo.

Automation

Special machine tools are illustrated, and methods of selecting automated machines are given — 24 pages. Snyder Tool & Engineering Co., 3400 E. Lafayette Ave., Detroit 7, Mich.

Fork Trucks

Advantages of the automatic transmission for fork lift trucks are described. Towmotor Corp., 1226 E. 152nd St., Cleveland 10, O.

Boron Handbook

Here are data on boron carbide and elemental boron—16 pages. Norton Co., Worcester 6, Mass.

Metal Finishing

Folder lists chemicals for metal finishing—24 pages. Enthone Inc., 442 Elm St., New Haven 11, Conn.

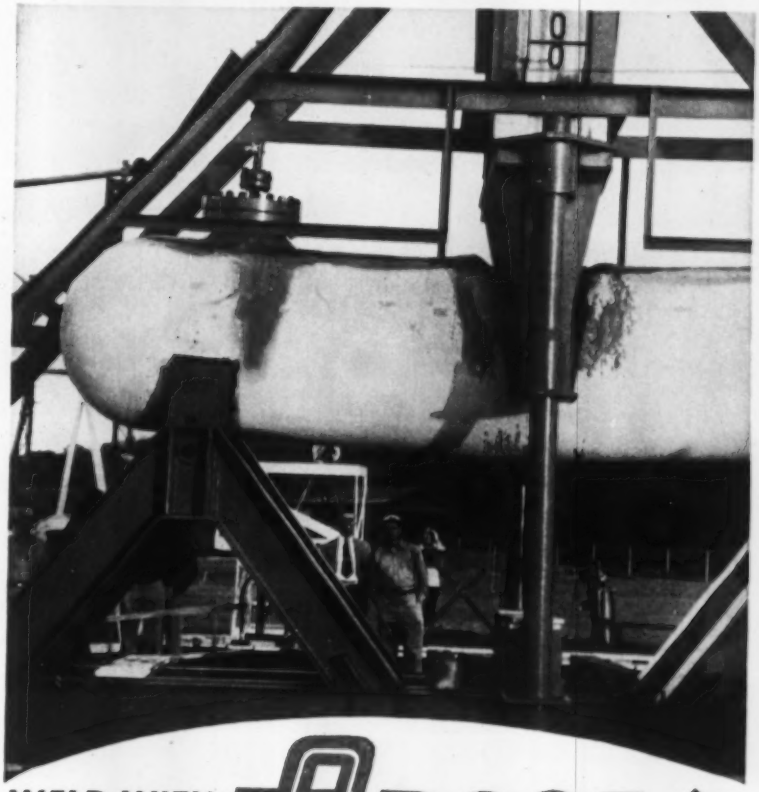
Paperboard

Folder gives uses of continuous paperboard sheet—12 pages. Dept. 11, National Container Corp., 7 Central Park W., New York, N. Y.

Forged Rings and Flanges

Design advantages and cost-cutting applications of forgings in industrial

Proof of how to weld Constructional Alloy steels for maximum strength



WELD WITH ARCOS

LOW HYDROGEN ELECTRODES

The above test vessel* was welded with ARCOS Low Hydrogen Electrodes without stress relieving. After being refrigerated to −33°F, and pressurized to 1,875 p.s.i., a 13-ton ingot was dropped on it from 73 ft. All steel and welds remained intact—proof of how Arcos weld metal can meet the severest requirements of strength, low temperature impact, and pressure. ARCOS CORPORATION, 1500 South 50th Street, Philadelphia 43, Pa.

*Made of USS "T-1"—new super tough alloy steel developed by U. S. Steel. Test conducted jointly by Chicago Bridge & Iron Co. and U. S. Steel.

Due to the unusual deep socket in the above Adjusting Screw it could not be formed from regular annealed and processed cold heading wire.

Keystone's metallurgist recommended Keystone "Special Processed" wire. The manufacturer has now standardized on "Special Processed" wire for this and other difficult cold headed parts. His results have been improved quality, increased production and lower cost per unit.

The superior grain flow characteristics of Keystone "Special Processed" wire provide the necessary upsetting and die forming qualities to withstand the terrific metal displacement in your most difficult cold heading jobs. Your inquiry is welcomed.

Keystone Steel & Wire Company
Peoria 7, Illinois
Industrial Wire Specialists

processing equipment and machinery are given—bulletin 10,000, 12 pages. Standard Steel Works Division, Baldwin-Lima-Hamilton Corp., Burnham, Pa.

Heat Transfer

Diagrams and drawings show combustion and heat transfer equipment in use—bulletin 108, 8 pages. Thermal Research & Engineering Corp., Conshohocken, Pa.

Screw Gage

Offered is a tool for gaging machine screws, wood screws and round stock—Dayton Rogers Mfg. Co., 2824 13th Ave. S., Minneapolis 7, Minn.

Seamless Welding Fittings

Alloy, carbon and stainless fittings, their types, grades and sizes are covered—bulletin FB-500, 6 pages. Tubular Products Division, Babcock & Wilcox Co., Beaver Falls, Pa.

Cranes

The use of cranes in automation is described—bulletin M-30, 11 pages. Whiting Corp., Harvey, Ill.

Tool Catalog

Milling cutters and tool holders are covered—44 pages. Viking Tool Co., P. O. Box 471, Shelton, Conn.

Cutter Catalog

Milling cutters, counterbores, end mills and hobs are listed—catalog 18-C, 48 pages. National Twist Drill & Tool Co., Rochester, Mich.

Laboratory Equipment

Equipment for ore testing labs is listed—catalog LG3-B10, 76 pages. Denver Equipment Co., P. O. Box 5268, Denver 17, Colo.

Needle Rollers

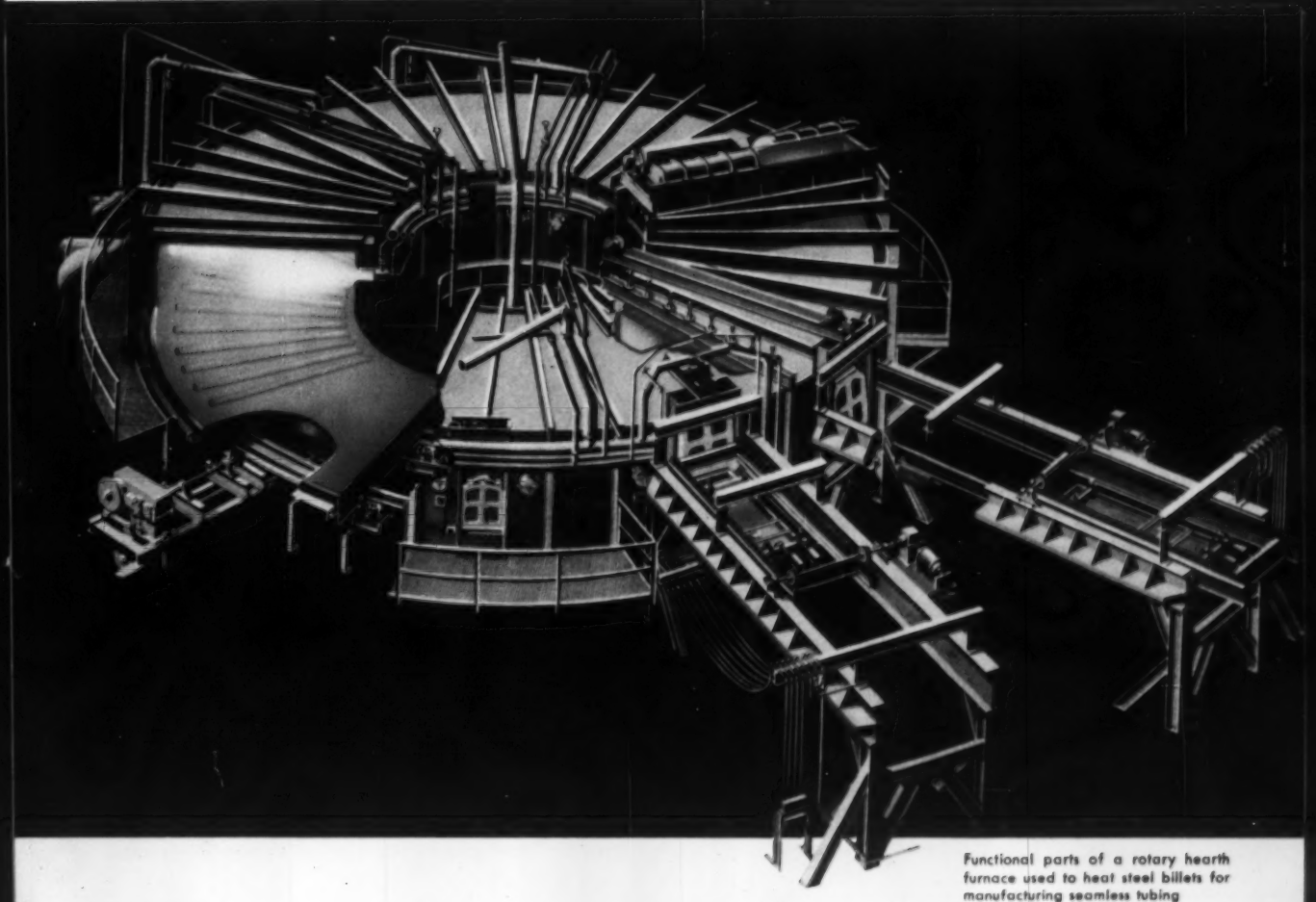
Charts, formulas and illustrations cover precision needle rollers—catalog 61, 12 pages. Kaydon Engineering Corp., Muskegon, Mich.

Cold Forming

Machines for forming toothed parts are shown in action photos—bulletin RF-55, 8 pages. Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

Cutting Fluids

Booklet tells how to handle cutting fluids used in machining stainless steel. Vanton Pump & Engineering Corp., Division Cooper Alloy Corp., 201 Sweetland Ave., Hillside, N. J.



Functional parts of a rotary hearth furnace used to heat steel billets for manufacturing seamless tubing

Increase Productivity, Save Space, And Cut Fuel Costs With Salem-Brosius Rotary Hearth Furnaces

Most large rotary hearth furnaces in the world have been designed and built by Salem-Brosius or its licensees. Salem-Brosius developed the large rotary hearth furnace and continuously has improved its design and construction.

Salem-Brosius rotary hearth furnaces are in use today for production heating and heat treating carbon and alloy steel bars, slabs, round and square billets, shell stock and forging stock; and similar products in non-ferrous metals such as copper and brass.

The rotary type furnace saves floor space. Fuel efficiencies and economies are unequalled by any other type of industrial furnace. Heating is rapid and uniform. Charging and discharging is mechanical; and automaticity of control drastically cuts labor costs. A Salem-Brosius rotary hearth assures the minimum of maintenance and repair costs. These benefits spell higher furnace output, less downtime, lower production cost—and greater profit to you, the user.

The rotary hearth is but one of the many types of Salem-Brosius furnaces—furnaces of superior design and construction—furnaces that help improve your product and turn it out at a lower cost. If your plant modernization plans call for heating or heat treating furnaces of any kind, call on Salem-Brosius.

Other Salem-Brosius products include forging manipulators, furnace charging and discharging equipment, hot materials handling equipment, large gas main valves, blast furnace clay guns, and a long list of special machinery and auxiliary furnace equipment. A Salem-Brosius engineer will be glad to help you with problems involving any of this equipment, or any special equipment that must be tailored to your needs. Write to us.

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CARNEGIE, PENNSYLVANIA

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Sales Offices in Principal Cities

Market Outlook

BY MIDWEEK as much steel will have been produced this year as in all of 1954. Last year's output was 88,311,652 net tons of steel for ingots and castings.

This year's production appears to be headed for a new record of between 115 million and 116 million tons. The record, 111,609,719 tons, was set in 1953. If production hits 116 million tons, the industry will have operated at an average of 92 per cent of capacity this year. Last year's average was only 71 per cent.

PUSH-UP—Heavy demand for steel and favorable conditions for production pushed steel ingot output up 1 point in the week ended Oct. 9 to 97 per cent of capacity, highest rate since the last week of June.

A LOOK TO '56—Some of the business analysts looking ahead to 1956 have a feeling steel production then will approximate the 1955 output, with the tendency to be on the downside if there is any change.

Steel buyers already are clamoring to get on 1956 order books. Although the government put some restrictions on credit to prevent a runaway boom, many people think the reins will be loosened enough to give business a thrust forward in time to influence next year's national elections. That would tend to keep steel production high.

INVENTORY MINDED—One support to steel production next year might be the building of inventory. Users have been inclined this year to add to inventories, but they haven't accumulated much.

An exception to this is the automobile industry. It has continued to take in steel during model change-overs, a period of low consumption. Automakers expect to chew up a lot of this steel in their early runs on 1956 models.

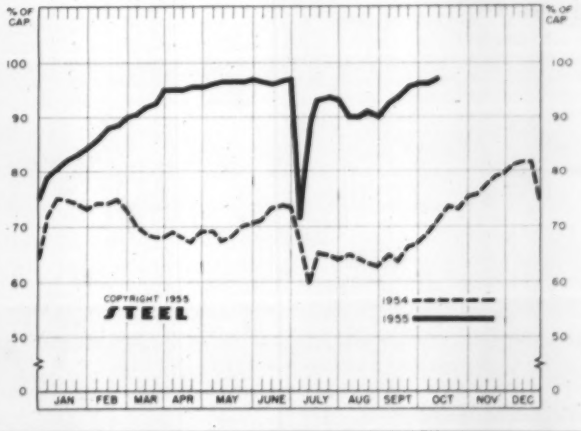
Appliance makers continue to press for steel. Household appliances are readily available in the stores, but they are being moved fast enough to keep the makers in the market for steel.

SLOWDOWN—Structurals have been a strong point in steel demand this year, but orders for fabricated material have eased. In August, orders for fabricated structural steel declined to 311,453 tons from the all-time record of 369,414 tons in the preceding month. Even so, August was the third highest month of this year. Historically, bookings decline in August. The present lag should not be prolonged, because a lot of work is being figured. Some fabricators say they can stand a little breather. Their delivery promises have become well extended, and there is a shortage of plain material.

SEEKING TO SAVE—The demand for steel is being abetted by the high price of copper. Superior Steel Corp., Carnegie, Pa., says there's a gradual increase in sales of its copper-clad strip as copper prices rise. Copper has risen around 65 per cent this year. This is prompting the use of copper-clad steel in place of solid copper.

Rise in tin plate prices on Oct. 1 pushed STEEL's price composite on finished steel to $128.14 a net ton, an increase of 73 cents. STEEL's price composite on steelmaking scrap advanced to $45.33 a gross ton.

NATIONAL STEELWORKS OPERATIONS



DISTRICT INGOT RATES

(Percentage of capacity engaged)

	Week Ended Oct. 9	Change	Same Week 1954	Same Week 1953
Pittsburgh	99.5	— 0.5*	74.5	97.5
Chicago	96.5	— 0.5*	72	97.5
Mid-Atlantic	94.5	+ 0.5	63	97
Youngstown	100	0	60	105
Wheeling	97.5	0	86.5	97
Cleveland	101	+ 1.5*	77.5	101
Buffalo	105	0	68	106.5
Birmingham	97.5	+ 2	74	96.5
New England	89	+ 1	52	80
Cincinnati	89.5	+ 2.5	66	84
St. Louis	88.5	0	75.5	103
Detroit	98	— 0.5	76	100
Western	99	0	87	102
National Rate	97	+ 1	71	95

INGOT PRODUCTION‡

	Week Ended Oct. 9	Week Ago	Month Ago	Year Ago
INDEX (1947-1949=100)	145.0†	145.7	140.9	105.3
NET TONS (In thousands)	2,330	2,341	2,264	1,692

*Change from preceding week's revised rate. †Estimated. ‡Amer. Iron & Steel Institute. Weekly capacity (net tons): 2,413,278 in 1955; 2,384,549 in 1954; 2,254,459 in 1953.

Metalworking Outlook—p. 93

Technical Outlook—p. 137

Price Indexes and Composites

FINISHED STEEL PRICE INDEX (Bureau of Labor Statistics)

	Oct. 4 1955	Sept. 27 1955	Month Ago	Sept. Average
(1947-1949=100)	154.5	153.9	153.9	153.9

AVERAGE PRICES OF STEEL (Bureau of Labor Statistics)

Week Ended Oct. 4

Prices include mill base prices and typical extras and deductions. Units are 100 lb except where otherwise noted in parentheses. For complete description of the following products and extras and deductions applicable to them write to STEEL.

Rails, Standard, No. 1	$4.800	Sheets, Electrical	$10.200
Rails, Light, 40 lb	6.217	Strip, C.R., Carbon	7.993
Tie Plates	5.625	Strip, C.R., Stainless, 430 (lb)	0.444
Axles, Railway	8.000	Strip, H.R., Carbon	5.350
Wheels, Freight Car, 33 in. (per wheel)	52.50	Pipe, Black, Buttweld (100 ft)	16.366
Plates, Carbon	4.950	Pipe, Galv., Buttweld (100 ft)	19.971
Structural Shapes	4.867	Pipe, Line (100 ft)	158.925
Bars, Tool Steel, Carbon (lb)	0.460	Casing, Oil Well, Carbon (100 ft)	165.120
Bars, Tool Steel Alloy, Oil Hardening Die (lb)	0.560	Casing, Oil Well, Alloy (100 ft)	244.670
Bars, Tool Steel, H.R., Alloy, High Speed W 6.75, Cr 4.5, V 2.1, Mo 5.5, C 0.60 (lb)	1.185	Tubes, Boiler (100 ft)	39.470
Bars, Tool Steels, H.R., Alloy, High Speed W 18, Cr 4, V 1 (lb)	1.680	Tubing, Mechanical, Carbon	20.980
Bars, H.R., Alloy	9.375	Tubing, Mechanical, Stainless, 304 (100 ft)	178.897
Bars, H.R., Stainless, 303 (lb)	0.450	Tin Plate, Hot-dipped, 1.25 lb	8.933
Bars, H.R., Carbon	5.350	Tin Plate, Electrolytic, 0.25 lb	7.633
Bars, Reinforcing	5.313	Black Plate, Canmaking Quality	6.733
Bars, C.F., Carbon	8.660	Wire, Drawn, Carbon	8.575
Bars, C.F., Alloy	12.175	Wire, Drawn, Stainless, 430 (lb)	0.578
Bars, C.F., Stainless, 302 (lb)	0.468	Bale Ties (bundle)	6.473
Sheets, H.R., Carbon	5.145	Nails, Wire, 8d Common	8.618
Sheets, C.R., Carbon	6.239	Wire, Barbed (80-rod spool)	7.847
Sheets, Galvanized	7.690	Woven Wire Fence (20-rod roll)	18.635
Sheets, C.R., Stainless, 302 (lb)	0.588		

STEEL's FINISHED STEEL PRICE INDEX*

	Oct. 5 1955	Week Ago	Month Ago	Year Ago	5 Yrs. Ago
Index (1935-39 av.=100)	208.97	207.63	207.63	194.53	157.28
Index in cents per lb	5.661	5.625	5.625	5.270	4.261

STEEL's ARITHMETICAL PRICE COMPOSITES

Finished Steel, NT*	$128.14	$127.41	$127.41	$117.95	$94.50
No. 2 Fdry, Pig Iron, GT	58.99	58.99	58.99	56.54	48.79
Basic Pig Iron, GT	58.49	58.49	58.49	56.04	47.72
Malleable Pig Iron, GT	59.77	59.77	59.77	57.27	49.20
Steelmaking Scrap, GT	45.33	45.00	44.00	32.00	41.00

*For explanation of weighted index see STEEL, Sept. 19, 1949, p. 54; of arithmetical price composite, STEEL, Sept. 1, 1952, p. 130.

Comparison of Prices

Comparative prices by districts, in cents per pound except as otherwise noted. Delivered prices based on nearest production point

FINISHED STEEL	Oct. 5 1955	Week Ago	Month Ago	Year Ago	5 Yrs. Ago
Bars, H.R., Pittsburgh	4.65	4.65	4.65	4.30	3.45
Bars, H.R., Chicago	4.65	4.65	4.65	4.30	3.45
Bars, H.R., deld. Philadelphia	4.90	4.90	4.90	4.55	3.93
Bar, C.F., Pittsburgh	5.90	5.90	5.90	5.40	4.10-4.15
Shapes Std., Pittsburgh	4.60	4.60	4.60	4.25	3.40
Shapes, Std., Chicago	4.60	4.60	4.60	4.25	3.40
Shapes, deld., Philadelphia	4.88	4.88	4.88	4.53	3.46
Plates, Pittsburgh	4.50	4.50	4.50	4.225	3.50
Plates, Chicago	4.50	4.50	4.50	4.225	3.50
Plates, Coatesville, Pa.	4.50	4.50	4.50	4.225	3.90
Plates, Sparrows Point, Md.	4.50	4.50	4.50	4.225	3.50
Plates, Claymont, Del.	4.50	4.50	4.50	4.225	3.90
Sheets, H.R., Pittsburgh	4.325	4.325	4.325	4.05	3.35
Sheets, H.R., Chicago	4.325	4.325	4.325	4.05	3.35
Sheets, C.R., Pittsburgh	5.325	5.325	5.325	4.95	4.10
Sheets, C.R., Chicago	5.325	5.325	5.325	4.95	4.10
Sheets, C.R., Detroit	5.325-5.425	5.325-5.425	5.325-5.425	5.10	4.30
Sheets, Galv., Pittsburgh	5.85	5.85	5.85	5.45	4.40
Strip, H.R., Pittsburgh	4.325	4.325	4.325	4.05	3.50
Strip, H.R., Chicago	4.325	4.325	4.325	4.05	3.25
Strip, C.R., Pittsburgh	6.25-6.45	6.25-6.45	6.25-6.45	5.75	4.15-4.50
Strip, C.R., Chicago	6.35-6.45	6.35-6.45	6.35-6.45	6.00	4.30
Strip, C.R., Detroit	6.35	6.35	6.35	5.60-5.90	4.35-4.95
Wire, Basic, Pittsburgh	6.25	6.25	6.25	5.75	4.50-4.75
Nails, Wire, Pittsburgh	7.60	7.60	7.60	6.85	5.30
Tin plate (1.50 lb), box, Pitts.	$9.45	$9.05	$9.05	$9.05	$7.50
SEMIFINISHED STEEL					
Billets, Forging, Pitts. (NT)	$84.50	$84.50	$84.50	$78.00	$63.00
Wire rods, 1/4-9/16" Pitts.	5.025	5.025	5.025	4.675	3.85
PIG IRON, Gross Ton					
Bessemer, Pitts.	$59.50	$59.50	$59.50	$57.00	$48.50
Basic, Valley	58.50	58.50	58.50	56.00	47.50
Basic, deld. Phila.	59.16	59.16	59.16	59.66	50.39
No. 2 Fdry, Pitts.	59.00	59.00	59.00	56.50	49.50
No. 2 Fdry, Chicago	59.00	59.00	59.00	56.50	48.00
No. 2 Fdry, Valley	59.00	59.00	59.00	56.50	49.50
No. 2 Fdry, deld. Phila.	59.66	59.66	59.66	50.16	50.89
No. 2 Fdry, Birm.	55.00	55.00	55.00	52.88	45.88
No. 2 Fdry (Birm.) deld. Cin.	62.70	62.70	62.70	60.62	52.58
Malleable, Valley	59.00	59.00	59.00	56.50	49.50
Malleable, Chicago	59.00	59.00	59.00	56.50	48.00
Ferromanganese, Duquesne	190.00†	190.00†	190.00†	190.00†	175.00*

†74-76% Mn, net ton. *75-82% Mn, gross ton, Etna, Pa.

SCRAP, Gross Ton (Including broker's commission)

No. 1 Heavy Melt, Pitts.	$44.50	$43.50	$43.50	$32.50	$44.00
No. 1 Heavy Melt, E. Pa.	46.50	46.50	46.50	30.50	39.00
No. 1 Heavy Melt, Chicago	45.00	45.00	42.00	33.00	40.00
No. 1 Heavy Melt, Valley	48.00	46.50	46.50	35.00	43.75
No. 1 Heavy Melt, Cleve.	44.50	44.00	44.00	32.00	43.00
No. 1 Heavy Melt, Buffalo	38.50	38.50	39.50	30.50	41.50
Rails, Rerolling, Chicago	65.50	65.50	64.50	51.50	61.00
No. 1 Cast, Chicago	48.50	48.50	46.50	39.50	50.50
COKE, Net Ton					
Beehive, Furn, Connisvl.	$13.625	$13.625	$13.625	$13.75	$14.25
Beehive, Fdry, Connisvl.	16.50	16.50	16.50	16.75	16.50
Oven, Fdry, Chicago	25.75	25.75	25.75	24.50	21.00

Daily Nonferrous Price Record

	Price Oct. 5	Last Change	Previous Price	Sept. Avg.	Aug. Avg.	Oct. 1954 Avg.
Copper	43.00-50.00	Sept. 12, 1955	43.00	45.380	37.759	30.000
Lead	15.30	Sept. 26, 1955	14.80	14.920	14.800	14.775
Zinc	13.00	Sept. 6, 1955	12.50	12.940	12.500	11.500
Tin	96.25	Oct. 5, 1955	96.375	96.565	96.519	93.110
Nickel	64.50	Nov. 24, 1954	60.00	64.500	64.500	60.000
Aluminum	24.40	Aug. 8, 1955	23.20-24.40	24.400	24.267	22.200
Magnesium	32.50	Aug. 16, 1955	28.50	32.500	30.574	27.000

Quotations in cents per pound based on: COPPER, deld. Conn. Valley; LEAD, common grade, deld. St. Louis; ZINC, prime western, E. St. Louis; TIN, Straits, deld. New York; NICKEL, electrolytic cathodes, 99.9%, base size at refinery, unpacked; ALUMINUM, primary ingots, 99 + %, deld.; MAGNESIUM, 99.8%, Freeport, Tex.

What You Can Use the Markets Section for:

- **A source of price information.**
  Current prices are reported each week. Price changes are shown in italics. Price trends are shown in tables of indexes and comparisons.
- **A directory of producing points.**
  Want to know who makes something, or where it is made? The steel price tables alphabetically list the cities of production and indicate the producing company. If you are a buyer, you may want to make a map showing comparative distances of sources of supply and to help you compute freight costs. If you are a seller of supplies you can make a map to spot your sales possibilities.
- **A source of price data for making your own comparisons.**
  Maybe you want to keep a continuous record of price spread between various forms of steel. You can get your base price information from STEEL's price tables.
- **A source of information on market trends.**
  Newsy items tell you about the supply-demand situation of materials, including iron and steel, nonferrous metals and scrap. Other articles analyze special situations of interest and importance to you.
- **Reports on iron and steel production, and materials and product shipments.**

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Nonferrous Metals

Protective coatings hold the key to converting molybdenum from a successful alloying agent to an even more promising base material for gas turbines, ramjets, etc.

Nonferrous Metal Prices, Pages 264 & 265

AFTER BEING a successful alloying material for 30 years, molybdenum is well on its way to becoming a base material, predicts Robert S. Archer, chief metallurgist for Climax Molybdenum Co., New York.

Arc-cast molybdenum, which allows the material to be produced in completely solid form, will be shown by Climax Molybdenum at the Metal Show next week in Philadelphia. Prior to the arc-casting process, all commercial metallic molybdenum was produced by compressing and sintering the powdered metal.

The largest furnace at Climax has produced 1000-lb molybdenum ingots 9 in. in diameter. By adding some electrical power and making minor equipment changes, these furnaces could produce ingots weighing up to a ton. "There is no reason," say company officials, "why the present furnace design could not be revamped so that ingots in the future could be 5 ft long and have 18-in. diameters."

Statistics — Molybdenum has a melting point of 4730° F (almost 2000° F higher than iron) and offers a useful strength which is greater than any other known material at operating temperatures over 1600° F. The drawback: Molybdenum oxidizes rapidly at temperatures above 1000° F. This deficiency has held back many high temperature uses.

Climax feels that the solution rests in protective coatings—one has withstood repeated heating and cooling for some 500 cycles. Applied with a spray gun, the coating is a mixture of powder which contains 20 per cent aluminum and an 80 per cent alloy (some 56 per cent chromium and 41 per cent silicon). All parts are coated with aluminum oxide to prevent adherence. After heating, the coating can be ground without chipping.

Results—Arc-cast molybdenum is similar to powder molybdenum but is superior to it in at least two respects: 1. It does not spall and crack when thin sections are machined. 2. A better finish can be obtained.

Where will metallic molybdenum be used? Since the development of the steam turbine, engineers have been looking for materials which would allow increased operating temperatures. If metallic molybdenum is successful, it would open temperature fields well over the present 1650° F for jet engines.

Possible applications include gas turbines, ramjets, guided missiles, nuclear reactors and hot-work dies. Hot-work die applications provide a promising field, particularly in die-casting brass and other alloys which have relatively high melting points.

Various firms and research organizations are conducting at least two other phases of experimentation to help raise operating temperatures: 1. Improved cermets with better resistance to impact and thermal shock. 2. Vacuum melting processes to produce better nickel and cobalt-base materials.

STEEL's Metal Price Averages for Sept., 1955

(Cents per lb)

Electrolytic Copper, deld. Connecticut	45.380
Lead, St. Louis	14.920
Prime Western Zinc, E. St. Louis, Ill.	12.940
Straits Tin, New York	96.565
Primary Aluminum Ingots, deld.	24.400
Magnesium, Freeport, Tex.	32.500
Nickel, f.o.b. refinery	64.500

Magnesium Production Jumps

The Magnesium Association, New York, reports that wrought magnesium production may pass the 10,000-ton mark in 1955. This would wipe out the 1951 record of 9500 tons. August tonnage (871 tons) was up 20 per cent from the previous month and rose some 57 per cent over the August total for last year.

Primary ingot production rose 15 per cent over July totals and topped last year's August production by 1 per cent. This is the first time this year that a monthly figure has exceeded the totals for the corresponding month in 1954. It now appears, says the association, that ingot production will "approximate some 60,000 ingot tons despite a poor second quarter, when strikes cut into production schedules."

Will GSA Buy Zinc, Lead?

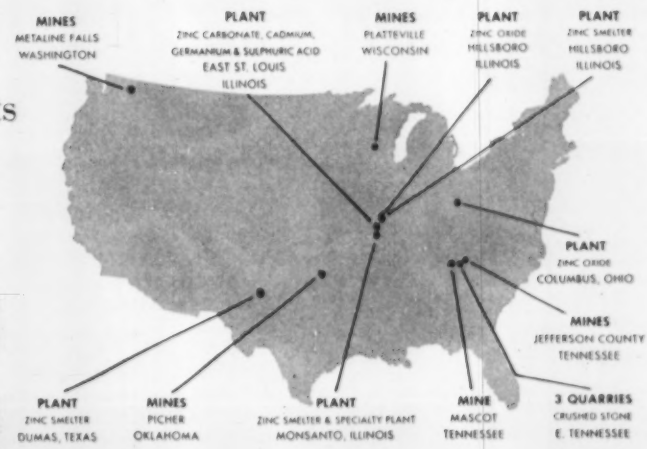
The General Services Administration has indicated that it will not pay more than 28 cents a lb for the combined price of lead and zinc. Due to lead's recent increase (to 15½-cents), the price structure for the two metals is 28½-cents a pound. The outlook: The government was offered only 1000 tons of lead for stockpile in August. Previous industry offers ran between 8000 and 10,000 tons. With the time for the government's call still a week or two away, producers are far from excited. Civilian demand is high. If the government wants these two metals for stockpile, it may have to pay the price.

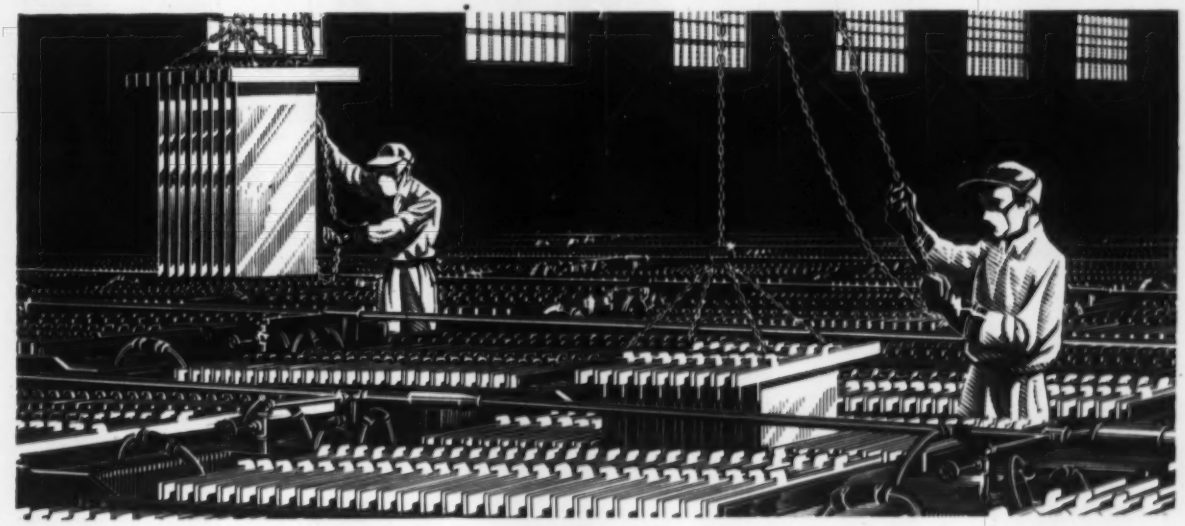
Coming: More Chilean Copper

Anaconda Co. will continue to expand its Chilean copper operations. After receiving Chile's highest award for a foreigner (Order of Merit in the Rank of Knight Commander), Thomas A. Campbell, executive vice president of Anaconda's Chile Exploration Co., announced that the long dormant Africana Mine of the Santiago Mining Co. will be opened and that a reduction plant will be constructed for the beneficiation of its ores.

Mr. Campbell reports that Anaconda will invest some $38 million in the Chuquicamata mine to increase its yield by about 100 million lb per year. Part of the outlay will go into a new hospital, more housing and other welfare improvements. The refining installations at Potrerillos, producing 75 million lb of copper in blister form, will refine and cast the copper into electrolytic shapes. "And," says Mr. Campbell, "our prospective new mine at Indio Muerto should eventually add a considerable share to the growing output of Chilean copper. We foresee Chile in the not too distant future assuming its rightful place as the leading copper producing country of the world."

American Zinc and its products *from* A *to* Z





OPERATIONS AT
MONSANTO, ILLINOIS

Modern and recently expanded electrolytic plant producing special high grade slab zinc, which is sold primarily to the die casting and brass manufacturing industries. In conjunction is a specialty plant for the production of zinc ball anodes, heavy plating anodes and anodes for cathodic protection. For complete picture of American Zinc operations, see map above.

PRODUCERS OF

ALL GRADES OF SLAB ZINC
ZINC ANODES (Plating & Galvanic)
METALLIC CADMIUM
SULPHURIC ACID
LEAD-FREE and LEADED ZINC OXIDES
ZINC CARBONATE
GERMANIUM DIOXIDE
AGRICULTURAL LIMESTONE
CRUSHED STONE

Distributors for

American Zinc sales Company

AMERICAN ZINC, LEAD & SMELTING COMPANY

Columbus, Ohio • Chicago • St. Louis • New York • Detroit • Pittsburgh

Nonferrous Metals

Cents per pound, carlots, except as otherwise noted.

PRIMARY METALS AND ALLOYS

Aluminum: 99 + %, ingots 24.40, pigs 22.50. 10,000 lb or more, f.o.b. shipping point. Freight allowed on 500 lb or more.

Aluminum Alloy: No. 13, 12% Si, 26.2; No. 43, 5% Si, 26.00; No. 142, 4% Cu, 1.5% Mg, 2% Ni, 28.20; No. 195, 4.5% Cu, 0.8% Si, 27.60; No 214, 3.8% Mg, 27.80, No. 356, 7% Si, 0.3% Mg, 26.20.

Antimony: R.M.M. brand, 99.5%, 33.00. Lone Star brand, 33.50, f.o.b. Laredo, Tex., in bulk. Foreign brands, 99.5%, 27.50-28.50, New York, duty paid, 10,000 lb or more.

Beryllium: 97%, lump or beads, $71.50 per lb, f.o.b. Cleveland or Reading, Pa.

Beryllium Aluminum: 5% Be, $72.75 per lb of contained Be, f.o.b. Reading, Pa., Elmore, O.

Beryllium Copper: 3.75-4.25% Be, $43 per lb of contained Be, with balance as Cu at market price on shipment date, f.o.b. Reading, Pa., or Elmore, O.

Bismuth: $2.25 per lb, ton lots.

Cadmium: Sticks and bars, $1.70 per lb, deld.

Cobalt: 97-99%, $2.60 per lb for 550-lb keg; $2.62 per lb for 100-lb case; $2.67 per lb under 100 lb.

Columbium: Powder, $119.20 per lb, nom.

Copper: Electrolytic, 43.00 deld. Conn. Valley; 43.00 deld. Midwest; custom smelters, 50.00 deld.; Lake, 43.00 deld.; Fire refined, 42.75 deld.

Germanium: 99.9% $295 per lb, nom.

Gold: U. S. Treasury, $35 per oz.

Indium: 99.9%, $2.25 per troy oz.

Iridium: $90-$110 nom, per troy oz.

Lead: Common, 15.30, chemical, 15.40, corroding, 15.40, St. Louis. New York basis, add 0.20.

Lithium: 99% +, cups or ingot, $11.50; rod, $13.50; shot or wire, $14.50, f.o.b. Minneapolis, 100 lb lots.

Magnesium: 99.8%, self-palletizing pig, 32.50; notched ingot, 33.25, 10,000 lb or more, f.o.b. Freeport, Tex. For Port Newark, N. J., add 1.40 for pig and 1.45 for ingot; for Madison, Ill., add 1.20 for pig and 1.25 for ingot; for Los Angeles, add 2.00 for both pig and ingot. Sticks 1.3 in. diameter, 53.00, 100 to 4999 lb, f.o.b. Madison, Ill.

Magnesium Alloys: AZ91C and alloys C, G, H and R, 36.00; alloy M, 38.00, 10,000 lb or more, f.o.b. Freeport, Tex. For Port Newark, N. J., add 1.40; for Madison, Ill., add 0.50; for Los Angeles, add 2.50.

Mercury: Open market, spot, New York, $272-$278 per 76-lb flask.

Molybdenum: Powder 99% hydrogen reduced, $3-$3.25 per lb; pressed ingot, $4.06 per lb; sintered ingot, $5.53 per lb.

Nickel: Electrolytic cathodes, sheets (4 x 4 in. and larger), unpacked, 64.50; 10-lb pigs, unpacked, 67.65; "XX" nickel shot, 69.00; "F" nickel shot or ingots for addition to cast iron, 64.50; prices f.o.b. Port Colborne, Ont., including import duty. New York basis, add 0.92.

Osmium: $80-$100, nom., per troy oz.

Palladium: $22-$24 per troy oz.

Platinum: $91-$96 per troy oz from refineries.

Radium: $16-$21.50 per mg radium content depending on quantity.

Rhodium: $118-$125 per troy oz.

Ruthenium: $45-$55 per troy oz.

Selenium: 99.5%, $9-$10 per lb.

Silver: Open market, 91.875 per troy oz.

Sodium: 16.50, c.l.; 17.00, l.c.l.

Tantalum: Sheet, rod, $68.70 per lb; powder $56.63 per lb.

Tellurium: $1.75 per lb.

Thallium: $12.50 per lb.

Tin: Straits, N. Y., spot 96.25; prompt, 96.125.

Titanium: Sponge, 99.3 + %, grade A-1 ductile (0.3% Fe max), $3.95, grade A-2 (0.5% Fe max), $3.50 per pound.

Tungsten: Powder, 98.8%, carbon, reduced, 1000-lb lots, $4.50 per lb, nom., f.o.b. shipping point; less than 1000 lb add 15.00; 99 + % hydrogen reduced, $4.65. Treated ingots, $6.70.

Zinc: Prime Western, 13.00; brass special, 13.25; intermediate, 13.50, E. St. Louis, freight allowed over 0.50 per pound. High grade, 14.35; special high grade, 14.50, deld. Diecasting alloy ingot No. 3, 17.25; No. 2, 18.25; No 5, 17.75, deld.

Zirconium: Ingots, commercial grade, 14.40 per lb; low-hafnium reactor grade, $23.07. Sponge, $10 per lb. Powder electronics grade, $15 per lb; flash grade, $11.50.

(Note: Chromium, manganese and silicon metals are listed in ferroalloy section.)

SECONDARY METALS AND ALLOYS

Aluminum Ingot: Piston alloys, 31.00-33.00; No. 12 foundry alloy (No. 2 grade), 31.25-31.50; 5% silicon alloy, 0.60 Cu max, 32.75-33.00; 13 alloy, 0.60 Cu max, 32.75-33.00; 195 alloy, 32.75-33.25; 108 alloy, 31.50-32.00. Steel deoxidizing grades, notch bars, granulated or shot: Grade 1, 31.00-32.25; grade 2, 30.00-31.25; grade 3, 29.25-30.50; grade 4, 28.50-30.00.

Brass Ingot: Red brass No. 115, 42.50; tin bronze No. 225, 56.50; No. 245, 48.75; high-leaded tin bronze No. 305, 45.75; No. 1 yellow No. 405, 34.75; manganese bronze No. 421, 38.25.

Magnesium Alloy Ingot: AZ63A, 34.00; AZ91B, 34.00; AZ91C, 34.00; AZ92A, 34.00.

NONFERROUS MILL PRODUCTS

BERYLLIUM COPPER

(Base prices per lb, plus mill extras, 2000 to 5000 lb, f.o.b. Temple, Pa.; nominal 1.9% Be alloy) Strip, $1.84; rod, bar, wire, $1.81.

COPPER WIRE

Bare, soft, f.o.b. eastern mills, 100,000-lb lots, 48.35; 30,000-lb lots 48.88; l.c.l., 48.98. Weatherproof, 100,000-lb lots, 46.03; 30,000-lb lots, 46.28; l.c.l., 46.78. Magnetic wire deld., 15,000 lb or more, 55.52; l.c.l., 56.27.

LEAD

(Prices to jobbers, f.o.b. Buffalo, Cleveland, Pittsburgh) Sheets, full rolls, 140 sq ft or more, $21 per cwt; pipe, full coils, $21 per cwt; traps and bends, list prices plus 30%

TITANIUM

(Prices per lb, 10,000 lb and over, f.o.b. mill) Sheets, $14.00-$14.50; sheared mill plate, $11.00; strip, $14.00-$14.50; wire, $10.00-$10.50; forging billets, $8.75; hot-rolled and forged bars, $8.75.

ZINC

(Prices per lb, c.l., f.o.b. mill) Sheets, 23.00; ribbon zinc in coils, 20.50; plates 19.50-22.25.

ZIRCONIUM

Plate, $22; H.R. strip, $19; C.R. strip, $29; forged or H.R. bars, $17; wire, 0.015 in., 1.00c per linear foot.

NICKEL, MONEL, INCONEL

	"A" Nickel	Monel	Inconel
Sheet, C.R.	102	78	99
Strip, C.R.	102	87	128
Plate, H.R.	97	82	95
Rod, Shapes H.R.	87	69	93
Rod, Shapes C.R.	91	75	118
Seamless Tubes	122	108	153
Shot, Blocks	...	65	...

ALUMINUM

Screw Machine Stock: 30,000 lb base.

Diam. (in.) or across flats	Round 2011-T3	Round 2017-T4	Hexagonal 2011-T3	Hexagonal 2017-T4
Drawn				
0.125	67.9	66.4	...	...
0.156-0.172	57.5	55.9	...	...
0.188	57.5	55.9	...	71.7
0.219-0.234	54.5	52.9	...	...
0.250-0.281	54.5	52.9	...	68.4
0.313	54.5	52.9	...	65.2
Cold-finished				
0.375-0.547	53.4	51.4	63.7	61.3
0.563-0.688	53.4	51.4	60.6	57.5
0.750-1.000	52.1	50.1	55.4	54.2
1.063	52.1	50.1	...	52.3
1.125-1.500	50.1	48.2	53.6	52.3
Rolled				
1.563	48.8	46.9	...	...
1.625-2.000	48.2	46.2	...	50.5
2.125-2.500	47.0	45.0	...	...
2.563-3.375	45.6	43.6	...	...

ALUMINUM

Sheets and Circles: 110 and 3003 mill finish (30,000 lb base; freight allowed)

Thickness Range Inches	Flat Sheet	Flat Sheet Circles*	Coiled Sheet	Coiled Sheet Circles†
0.249-0.136	37.5	42.3	...	...
0.135-0.096	38.0	43.2	...	...
0.095-0.077	38.7	44.2	36.1	41.3
0.076-0.061	39.3	45.1	36.3	41.5
0.060-0.048	39.9	45.6	36.7	42.0
0.047-0.038	40.4	46.5	37.2	42.4
0.037-0.039	40.8	47.0	37.6	43.1
0.029-0.024	41.4	47.5	37.9	43.6
0.023-0.019	42.2	49.0	38.8	44.5
0.018-0.017	43.0	...	39.4	45.4
0.016-0.015	43.9	...	40.2	46.6
0.014	44.9	...	41.2	47.9
0.013-0.012	46.1	...	41.9	48.9
0.011	47.1	...	43.1	50.5
0.010-0.0095	48.4	...	44.3	52.2
0.009-0.0085	49.7	...	45.8	54.3
0.008-0.0075	51.3	...	47.0	56.1
0.007	52.8	...	48.5	58.4
0.006	54.4	...	49.9	63.4

*48 in. max diam. †26 in. max diam.

ALUMINUM

Plates and Circles: Thickness 0.250-3 in. 24-60 in. width or diam. 72-240 in. lengths.

Alloy	Plate Base	Circle Base
1100-F, 3003-F	36.5	40.8
5050-F	37.6	41.9
3004-F	38.6	43.8
5052-F	39.9	45.2
6061-T6	41.1	46.0
2024-T4*	43.6	49.9
7075-T6*	51.4	58.5

*24-48 in. widths or diam, 72-180 in. lengths

ALUMINUM

Forging Stock: Round, Class 1, 39.10-50.10 in specific lengths 36-144 in., diameters 0.375-8 in. Rectangles and squares, Class 1, 43.00-56.20 in random lengths, 0.375-4 in. thick, widths 0.750-10 in.

Pipe: A.S.A. Schedule 40, alloy 6063-T6, 20-ft lengths, plain ends, 90,000-lb base, per 100 ft.

Nom. Pipe Size (in.)		Nom. Pipe Size (in.)	
¾	$16.85	2	$ 51.95
1	26.50	4	143.00
1¼	35.85	6	256.70
1½	42.90	8	386.30

MAGNESIUM

Sheet: AZ31, commercial grade, 0.032 in., 99c; 0.064 in., 78.00c; 0.125 in., 63.50c, 30,000 lb and over, f.o.b. mill.

Plate: AZ31, 61.00c, 30,000 lb or more, 0.250 in. and over, widths 24-60 in., lengths 72-180 in.; treat plate, 64.00c, 30,000 lb or more, ¼-in. thick, widths 24-60 in., lengths 60-192 in.; tooling plate, 66.00c, 30,000 lbs or more, .250-3.000 in., widths 60-72 in., lengths 72-180 in.

Extrusions: AZ31 commercial grade, rectangles, ⅛ x 2 in., 64.70c; 1 x 4 in., 69.50c. Rod, 1 in., 61.50c; 2 in., 59.00c. Tubing, 1 in. OD x 0.065 in., 82.50c; Angles, 1 x 1 x ⅛-in., 68.40c; 2 x 2 x ¼-in., 62.50c. Channels, 5 in., 63.40c. I-beams, 5 in., 62.70c.

NONFERROUS SCRAP

DEALER'S BUYING PRICES

(Cents per pound, New York, in ton lots)

Aluminum: 1100 clippings, 19.50; old sheets 17.00-17.50; borings and turnings, 11.00-11.50; crankcases, 17.00-17.50; industrial castings, 16.70-17.50.

Copper and Brass: No. 1 heavy copper and wire, 39.50-40.00; No. 2 heavy copper and wire, 37.50-39.00; light copper, 35.00-37.00; No. 1 composition red brass, 29.50-31.00; No. 1 composition turnings, 28.50-30.00; yellow

BRASS MILL PRICES

	MILL PRODUCTS a				SCRAP ALLOWANCES f		
	Sheet, Strip, Plate	Rod	Wire	Seamless Tube	Clean Heavy	Rod Ends	Clean Turnings
Copper	62.76b	60.36c	....	62.82	39.000	39.000	38.250
Yellow Brass	52.27	42.41d	52.81	55.18	28.875	28.625	26.750
Red Brass, 85%	58.09	58.03	58.63	60.90	34.250	34.000	33.500
Low Brass, 80%	56.55	56.49	57.09	59.36	32.750	32.250	31.750
Naval Brass	55.63	49.94	62.69	58.79	26.750	26.500	26.000
Com. Bronze, 90%	60.18	60.12	60.72	62.74	35.750	35.500	35.000
Nickel Silver, 10%	66.00	68.33g	68.33	....	32.500	32.250	16.250
Phos. Bronze, A, 5%	80.99	81.49	81.49	82.67	39.250	39.000	38.000
Silicon Bronze	66.54	65.73	66.58	68.68e	37.625	37.375	36.875
Manganese Bronze	59.37	53.38	63.82	....	27.000	26.750	25.750
Muntz Metal	53.74	49.55	....	....	27.000	26.750	26.250

a. Cents per lb, f.o.b. mill; freight allowed on 500 lb or more. b. Hot-rolled. c. Cold-drawn. d. Free cutting. e. 3% silicon. f. Prices in cents per lb for less than 20,000 lb, f.o.b. shipping point. On lots over 20,000 lb at one time, of any or all kinds of scrap, add 1 cent per lb. g. Leaded.

brass turnings, 18.50-19.00; new brass clippings, 25.00-26.50; light brass, 18.50-19.00; heavy yellow brass, 21.50-22.00; new brass rod ends, 23.50-25.00; auto radiators, unsweated, 23.50-24.50; cocks and faucets, 24.50-26.50; brass pipe, 24.50-27.00.

Lead: Heavy, 12.00-12.50; battery plates, 6.50-7.00; linotype and stereotype, 14.00-14.75; electrotype, 12.00-12.75; mixed babbitt, 14.50.

Magnesium: Clippings, 18.50-19.50; clean castings, 18.00-19.00; iron castings, not over 10% removable Fe, less full deduction for Fe, 16.00-17.00.

Monel: Clippings, 54.50-60.00; old sheets, 45.00-50.00; turnings, 54.00; rods, 54.50-60.00.

Nickel: Sheets and clips, 90.00-125.00; rolled anodes, 90.00-125.00; turnings, 75.00-100.00; rod ends, 90.00-125.00.

Zinc: Old zinc, 5.50-6.00; new die-cast scrap, 5.00-5.75; old die-cast scrap, 3.50-4.00.

REFINER'S BUYING PRICES
(Cents per pound, carlots, delivered refinery)

Aluminum: 1100 clippings, 23.00-23.50; 3003 clippings, 23.00-23.25; 6151 clippings, 23.00-23.25; 5052 clippings, 23.00-23.25; 2014 clippings, 21.50-22.50; 2017 clippings, 21.50-22.50; 2024 clippings, 21.50-22.50; mixed clippings, 21.50-23.00; old sheet, 19.00-20.00; old cast, 19.50-20.00; clean old cable (free of steel), 23.00; borings and turnings, 20.00-21.00.

Beryllium Copper: Heavy scrap, 0.020-in. and heavier, not less than 1.5% Be, 65.00; light scrap, 60.00; turnings and borings, 43.00-55.00.

Copper and Brass: No. 1 copper and wire, 43.00; No. 2 copper and wire, 41.50; light copper, 39.00; refinery brass (60% copper) per dry copper content, 37.50.

INGOTMAKERS' BUYING PRICES
(Cents per pound, carlots, delivered)

Copper and Brass: No. 1 copper and wire, 43.00; No. 2 copper and wire, 41.50; light copper 39.00; No. 1 composition borings, 34.00; No. 1 composition solids, 34.50; heavy yellow brass solids, 24.00; yellow brass turnings, 24.50; radiators, 27.00.

PLATING MATERIAL
(F.o.b. shipping point, freight allowed on quantities)

ANODES

Cadmium: Special or patented shapes, $1.70 per lb.

Copper: Flat-rolled, 59.42, oval, 58.92, 5000-10,000 lb; electrodeposited, 56.78, 2000-5000 lb lots; cast 62.54, 5000-10,00 lb quantities.

Nickel: Depolarized, less than 100 lb, $1.015; 100-499 lb, 99.50; 500-4999 lb, 95.50; 5000-29,999 lb, 93.50; 30,000 lb, 91.50. Carbonized, deduct 3 cents a lb. All prices eastern delivery effective Jan. 1, 1955.

Tin: Bar or slab, less than 200 lb, $1.145; 200-499 lb, $1.13; 500-999 lb, $1.125; 1000 lb or more, $1.12.

Zinc: Balls, 21.00; flat tops, 21.00; flats, 22.75; ovals, 22.00, ton lots.

CHEMICALS

Cadmium Oxide: $2.15 per lb, in 100-lb drums.

Chromic Acid: Less than 10,000 lb, 28.50; over 10,000 lb, 27.50.

Copper Cyanide: 100-1000 lb, 80.00; 1000 lb and over, 78.00; effective Sept. 1, 1955.

Copper Sulphate: Crystal, 100 lb, 21.50; 200 lb, 18.50; 300 lb, 17.50; 400 lb, 17.00; 500-1900 lb, 15.50; 2000-10,000 lb, 15.25; 10,000 lb and up, 15.15. Powder, add 0.5 to above prices. Effective Mar. 29, 1955.

Nickel Chloride: 100 lb, 46.50; 200 lb, 44.50; 300 lb, 43.50; 400-4900 lb, 41.50; 5000-9900 lb, 39.50; 10,000 lb and over, 38.50. All prices eastern delivery, efective Jan. 1, 1955.

Nickel Sulphate: 100 lb, 38.25; 200 lb, 36.25; 300 lb, 35.25; 400-4900 lb, 33.25; 5000-35,900 lb, 31.25; 36,000 lb, 30.25. All prices eastern delivery, effective Jan. 1, 1955.

Silver Cyanide: (Cents per ounce) 4-oz bottle, 83.125; 16-oz bottle, 81.875; 80-oz bottle, 79.375; 100-oz bottle, 79.375; f.o.b. St. Louis, New York and Los Angeles. Effective Apr. 6, 1955.

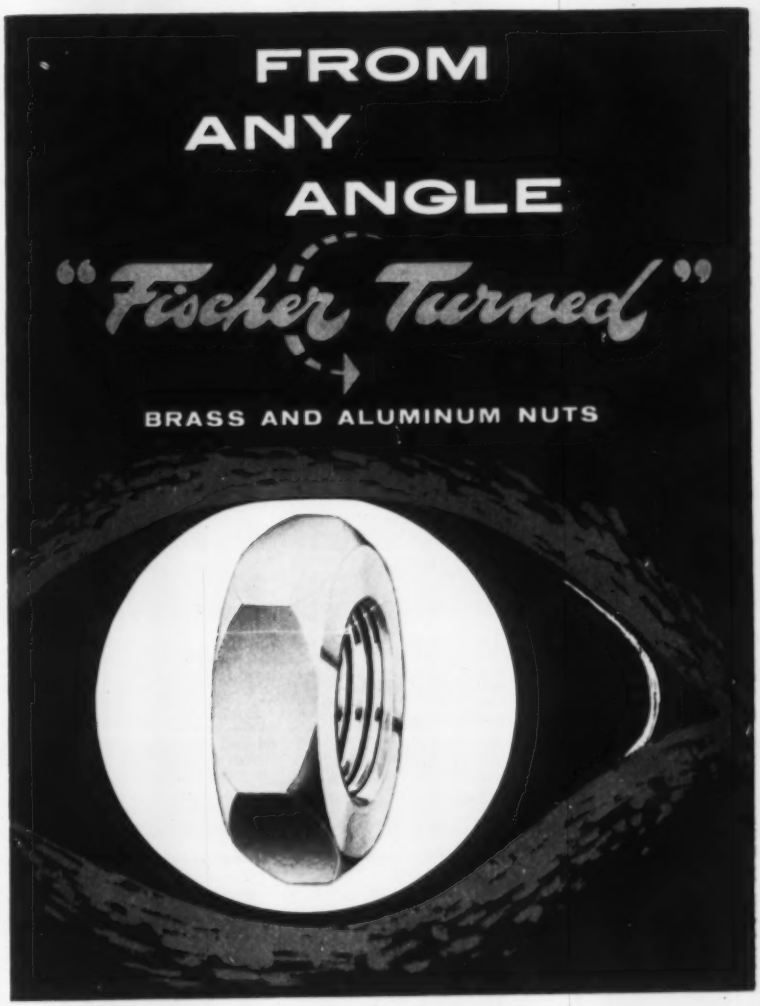
Sodium Cyanide: Egg, under 1000 lb, 19.80; 1000-19,900 lb, 18.80; 20,000 lb and over, 17.80; granular, add 1-cent premium to above.

Sodium Stannate: Less than 100 lb, 72.50; 100-600 lb, 58.10; 700-1900 lb, 55.70; 2000-9900 lb, 53.90; 10,000 lb or more, 52.80.

Stannous Chloride (Anhydrous): Less than 50 lb, $1.588; 50 lb, $1.248; 100-300 lb, $1.098; 400-900 lb, $1.074; 1000-1900 lb, $1.049; 2000-4900 lb, $1.013; 5000-19,900 lb, 95.20; 20,000 lb or more, 89.10.

Stannous Sulphate: Less than 50 lb, $1.287; 50 lb, 98.70; 100-1900 lb, 96.70; 2000 lb or more, 94.70.

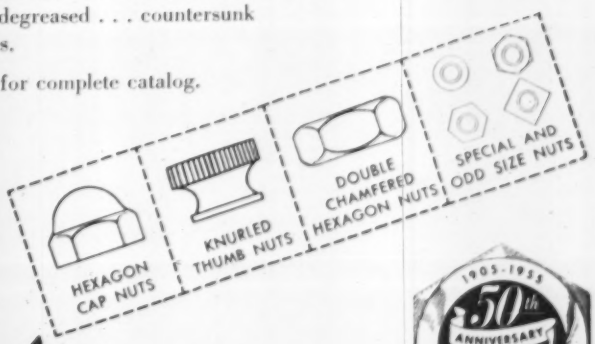
Zinc Cyanide: Under 1000 lb, 54.30; 1000 lb and over, 52.30.



Price, quality, delivery, technical assistance . . . any way you look at it . . . you can count on complete satisfaction if you specify "Fischer Turned" brass and aluminum nuts.

Standard or "specials", Fischer *turned* nuts cost no more than those produced by other, less accurate methods, yet each is burrless . . . tapped square with the face to Class 2 tolerances . . . cleaned and degreased . . . countersunk on both sides.

Write today for complete catalog.



1905-1955 50th ANNIVERSARY FISCHER SPECIAL MFG. CO CINCINNATI, OHIO

Fischer SPECIAL MFG. CO.

476 MORGAN STREET, CINCINNATI 6, OHIO

C-234-FS

Steel Prices

Mill prices as reported to STEEL, cents per pound except as otherwise noted. *Changes shown in italics.*
Code numbers following mill points indicate producing company. Key on page 267. Key to footnotes, page 269.

SEMIFINISHED

INGOTS, Carbon, Forging (NT)
Munhall,Pa. U5 .....$65.50

INGOTS, Alloy (NT)
Detroit R7 .....$69.00
Houston 85 .....74.00
Midland,Pa. C18 .....69.00
Munhall,Pa. U5 .....69.00

BILLETS, BLOOMS & SLABS Carbon, Rerolling (NT)
Aliquippa,Pa. J5 ....$68.50
Bessemer,Pa. U5 .....68.50
Bridgeport,Conn. N19..73.50
Buffalo R2 .....68.50
Clairton,Pa. U5 .....68.50
Ensley,Ala. T2 .....68.50
Fairfield,Ala T2 .....68.50
Fontana,Calif. K1 ....76.00
Gary,Ind. U5 .....68.50
Johnstown,Pa. B2 ....68.50
Lackawanna,N.Y. B2 ..68.50
LoneStar,Tex. L6 ....74.50
Munhall, Pa. U5 .....68.50
Pittsburgh J5 .....68.50
S.Chicago,Ill. R2, U5..68.50
S.Duquesne,Pa. U5 ...68.50
Youngstown R2 .....68.50

Carbon, Forging (NT)
Aliquippa,Pa. J5 ....$84.50
Bessemer,Pa. U5 .....84.50
Bridgeport,Conn. N19..89.50
Buffalo R2 .....84.50
Canton,O. R2, T7 .....86.50
Clairton,Pa. U5 .....84.50
Conshohocken,Pa. A3..89.50
Ensley,Ala. T2 .....84.50
Fairfield,Ala. T2 .....84.50
Fontana, Calif. K1 ....92.00
Gary,Ind. U5 .....84.50
Geneva,Utah C11 ....84.50
Houston 85 .....89.50
Johnstown,Pa. B2 ....84.50
Lackawanna,N.Y. B2..84.50
LosAngeles B3 .....94.00
Midland,Pa. C18 .....84.50
Munhall,Pa. U5 .....84.50
Pittsburgh J5 .....84.50
Seattle B3 .....98.00
S.Chicago R2,U5,W14..84.50
S.Duquesne,Pa. U5 ....84.50
S.SanFrancisco B3 ....94.00

Alloy, Forging (NT)
Bethlehem,Pa. B2 ...$96.00
Buffalo R2 .....96.00
Canton,O. R2, T7 ...96.00
Conshohocken,Pa. A3..103.00
Detroit R7 .....96.00
Fontana,Calif. K1 ....115.00
Gary,Ind. U5 .....96.00
Houston 85 .....101.00
Ind.Harbor,Ind. Y1 ...96.00
Johnstown,Pa. B2 ....96.00
Lackawanna,N.Y. B2 ..96.00
LosAngeles B3 .....116.00
Massillon,O. R2 .....96.00
Midland,Pa. C18 .....96.00
Munhall,Pa. U5 .....96.00
S.Chicago R2,U5,W14..96.00
S.Duquesne,Pa. U5 ...96.00
Struthers,O. Y1 .....96.00
Warren,O. C17 .....96.00

ROUNDS, SEAMLESS TUBE (NT)
Buffalo R2 .....$103.50
Canton,O. R2 .....103.50
Cleveland R2 .....103.50
Gary,Ind. U5 .....103.50
S.Chicago R2, W14 ...103.50
S.Duquesne,Pa. U5 ...103.50

SKELP
Aliquippa,Pa. J5 ....4.325
LoneStar,Tex. L6 ....4.625
Munhall,Pa. U5 .....4.225
SparrowsPoint,Md. B2..4.225
Warren,O. R2 .....4.225
Youngstown R2, U5 ...4.225

WIRE RODS
AlabamaCity,Ala. R2 ..5.025
Aliquippa,Pa. J5 .....5.025
Alton,Ill. L1 .....5.20
Buffalo B11, W12 ....5.025
Cleveland A7 .....5.025
Donora,Pa. A7 .....5.025
Fairfield,Ala. T2 .....5.025
Houston 85 .....5.275
IndianaHarbor,Ind. Y1..5.025
Johnstown,Pa. B2 ....5.025
Joliet,Ill. A7 .....5.025
KansasCity,Mo. 85 ....5.275
Kokomo,Ind. C16 ....5.125
LosAngeles B3 .....5.825
Minnequa,Colo. C10 ...5.275
Monessen,Pa. P7 .....5.025
N.Tonawanda,N.Y. B11..5.025
Pittsburg,Calif. C11 ...5.675
Portsmouth P12 .....5.025
Roebling,N.J. R5 ....5.125
S.Chicago,Ill. R2 .....5.025
SparrowsPoint,Md. B2..5.125
Sterling,Ill.(1) N15 ....5.025
Sterling,Ill. N15 .....5.125
Struthers,O. Y1 .....5.025
Worcester,Mass. A7 ...5.325

STRUCTURALS

Carbon Steel Std. Shapes
Ala.City,Ala. R2 .....4.60
Aliquippa,Pa. J5 .....4.60
Bessemer,Ala. T2 .....4.60
Bethlehem,Pa. B2 .....4.65
Birmingham C15 .....4.60
Clairton,Pa. U5 .....4.60
Fairfield,Ala. T2 .....4.60
Fontana,Calif. K1 ....5.25
Gary,Ind. U5 .....4.60
Geneva,Utah C11 .....4.60
Houston 85 .....4.70
Ind.Harbor,Ind. I-2 ....4.60
Johnstown,Pa. B2 ....4.65
KansasCity,Mo. 85 ....4.70
Lackawanna,N.Y. B2 ...4.65
LosAngeles B3 .....5.30
Minnequa,Colo. C10 ....4.90
Munhall,Pa. U5 .....4.60
Niles,Calif. P1 .....4.90
Portland,Oreg. O4 ....5.35
Phoenixville,Pa. P4 ....5.15
Seattle B3 .....5.35
S.Chicago U5, W14 ....4.60
S.SanFrancisco B3 ....5.25
Torrance,Calif. C11 ....5.30
Weirton,W.Va. W6 ....4.60

Wide Flange
Bethlehem,Pa. B2 .....4.65
Clairton,Pa. U5 .....4.60
Fontana,Calif. K1 ....5.40
Lackawanna,N.Y. B2 ...4.65
Munhall,Pa. U5 .....4.60
Phoenixville,Pa. P4 ....5.15
S.Chicago,Ill. U5 .....4.60

Alloy Std. Shapes
Clairton,Pa. U5 .....5.65
Fontana,Calif. K1 .....7.30
Gary,Ind. U5 .....5.65
Houston 85 .....5.75
Munhall,Pa. U5 .....5.65
S.Chicago,Ill. U5 .....5.65

H.S., L.A. Std. Shapes
Aliquippa,Pa. J5 .....6.75
Bessemer,Ala. T2 .....6.75
Bethlehem,Pa. B2 .....6.80
Clairton,Pa. U5 .....6.75
Fairfield,Ala. T2 .....6.75
Fontana,Calif. K1 ....7.40
Gary,Ind. U5 .....6.75
Geneva,Utah C11 .....6.75
Houston 85 .....6.85
Ind.Harbor,Ind. I-2, Y1..6.75
Johnstown,Pa. B2 ....6.80
KansasCity,Mo. 85 ....6.85
Lackawanna,N.Y. B2 ...6.80
LosAngeles B3 .....7.45
Munhall,Pa. U5 .....6.75
Seattle B3 .....7.50
S.Chicago,Ill. U5, W14..6.75
S.SanFrancisco B3 ....7.40
Struthers,O. Y1 .....6.75

H.S., L.A. Wide Flange
Bethlehem,Pa. B2 ....6.80
Lackawanna,N.Y. B2 ...6.80
Munhall,Pa. U5 .....6.75
S.Chicago,Ill. U5 .....6.75

PILING

BEARING PILES
Bethlehem,Pa. B2 .....4.65
Lackawanna,N.Y. B2 ...4.65
Munhall,Pa. U5 .....4.60
S.Chicago,Ill. U5 .....4.60

STEEL SHEET PILING
Ind.Harbor,Ind. I-2 ....5.45
Lackawanna,N.Y. B2 ...5.45
Munhall,Pa. U5 .....5.45
S.Chicago,Ill. U5 .....5.45

PLATES

PLATES, Carbon Steel
Ala.City,Ala. R2 .....4.50
Aliquippa,Pa. J5 .....4.50
Ashland,Ky.(15) A10 ...4.50
Bessemer,Ala. T2 .....4.50
Bridgeport,Conn. N19 ..4.75
Buffalo R2 .....4.50
Clairton,Pa. U5 .....4.50
Claymont,Del. C22 ....4.50
Cleveland J5, R2 .....4.60
Coatesville,Pa. L7 ....4.50
Conshohocken,Pa. A3 ..4.50
Detroit M1 .....4.60
Ecorse,Mich. G5 .....4.60
Fairfield,Ala. T2 .....4.50
Fontana,Calif.(30) K1 ...5.15
Gary,Ind. U5 .....4.50
Geneva,Utah C11 .....4.50
GraniteCity,Ill. G4 ....4.70
Harrisburg,Pa. C5 ....5.10
Houston 85 .....4.60
Ind.Harbor,Ind. I-2, Y1..4.50
Johnstown,Pa. B2 ....4.50
Lackawanna,N.Y. B2 ...4.50
LoneStar,Tex. L6 .....4.85
Mansfield,O. E6 .....4.50
Minnequa,Colo. C10 ....5.35
Munhall,Pa. U5 .....4.50
Newport,Ky. N9 .....4.50
Pittsburgh J5 .....4.50
Riverdale,Ill. A1 .....4.50
Seattle B3 .....5.40
Sharon,Pa. S3 .....4.50
S.Chicago R2, U5, W14..4.50
SparrowsPoint,Md. B2 ..4.50
Steubenville,O. W10 ....4.50
Warren,O. R2 .....4.50
Weirton,W.Va. W6 ....4.50
Youngstown R2, U5, Y1..4.50

PLATES, Carbon Abras. Resist.
Fontana,Calif. K1 .....6.30
Geneva,Utah C11 .....5.65
Johnstown,Pa. B2 .....5.65
SparrowsPoint,Md. B2 ..5.65

PLATES, Wrought Iron
Economy,Pa. B14 .....10.40

PLATES, High-Strength Low-Alloy
Aliquippa,Pa. J5 .....6.725
Bessemer,Ala. T2 .....6.725
Clairton,Pa. U5 .....6.725
Cleveland J5, R2 .....6.725
Coatesville,Pa. L7 .....6.725
Conshohocken,Pa. A3 ..6.725
Ecorse,Mich. G5 .....6.825
Fairfield,Ala. T2 .....6.725
Fontana,Calif.(30) K1 ..7.375
Gary,Ind. U5 .....6.725
Geneva,Utah C11 .....6.725
Houston 85 .....6.825
Ind.Harbor,Ind. I-2, Y1..6.725
Johnstown,Pa. B2 ....6.725
LosAngeles B3 .....7.625
Munhall,Pa. U5 .....6.725
Pittsburgh J5 .....6.725
Seattle B3 .....7.625
Sharon,Pa. S3 .....6.725
S.Chicago,Ill. U5, W14..6.725
SparrowsPoint,Md. B2..6.725
Youngstown U5, Y1 ...6.725

PLATES, Alloy
Bridgeport,Conn. N19 ...6.55
Claymont,Del. C22 ....6.30
Coatesville,Pa. L7 ....6.30
Fontana,Calif. K1 .....6.95
Gary,Ind. U5 .....6.30
Houston 85 .....6.40
Ind.Harbor,Ind. Y1 ....6.30
Johnstown,Pa. B2 ....6.30
Munhall,Pa. U5 .....6.30
Newport,Ky. N9 .....6.30
Seattle B3 .....7.20
Sharon,Pa. S3 .....6.30
S.Chicago,Ill. U5, W14..6.30
SparrowsPoint,Md. B2 ..6.30
Youngstown Y1 .....6.30

FLOOR PLATES
Cleveland J5 .....5.575
Conshohocken,Pa. A3 ..5.575
Harrisburg,Pa. C5 ....5.575
Ind.Harbor,Ind. I-2 ...5.575
Munhall,Pa. U5 .....5.575
S.Chicago,Ill. U5 .....5.575

PLATES, Ingot Iron
Ashland c.l. (15) A10...4.75
Ashland l.c.l. (15) A10..5.25
Cleveland c.l. R2 .....5.10
Warren,O. c.l. R2 .....5.10

BARS

BARS, Hot-Rolled Carbon
Ala.City,Ala. R2 .....4.65
Aliquippa,Pa. J5 .....4.65
Alton,Ill. L1 .....4.85
Atlanta A11 .....4.85
Bessemer,Ala. T2 .....4.65
Birmingham C15 .....4.65
Bridgeport,Conn. N19 ..4.80
Buffalo R2 .....4.65
Canton,O. R2 .....4.75
Clairton,Pa. U5 .....4.65
Cleveland R2 .....4.65
Ecorse,Mich. G5 .....4.75
Emeryville,Calif. J7 ....5.40
Fairfield,Ala. T2 .....4.65
FairlessHills,Pa. U5 ...4.80
Fontana,Calif. K1 .....5.35
Gary,Ind. U5 .....4.65
Houston 85 .....4.90
Ind.Harbor,Ind. I-2, Y1..4.65
Johnstown,Pa. B2 .....4.65
Joliet,Ill. P22 .....4.65
KansasCity,Mo. 85 ....4.90
Lackawanna,N.Y. B2 ...4.65
LosAngeles B3 .....5.35
Massillon,O. R2 .....4.75
Midland,Pa. C18 .....4.65
Milton,Pa. M18 .....4.65
Minnequa,Colo. C10 ....5.10
Niles,Calif. P1 .....5.00
N.Tonawanda,N.Y. B11..4.65
Pittsburg,Calif. C11 ....5.35
Pittsburgh J5 .....4.65
Portland,Oreg. O4 .....5.40
Seattle B3, N14 .....5.40
S.Chicago R2, U5, W14..4.65
S.Duquesne,Pa. U5 ....4.65
S.SanFran.,Calif. B3 ...5.40
Sterling,Ill.(1) N15 ....4.65
Sterling,Ill. N15 .....4.75
Struthers,O. Y1 .....4.65
Torrance,Calif. C11 ....5.35
Warren,O. R2 .....4.65
Weirton,W.Va. W6 ....4.65
Youngstown R2, U5 ....4.65

BARS, H.R. Loaded Alloy
Warren,O. C17 .....6.325

BARS, Hot-Rolled Alloy
Bethlehem,Pa. B2 ....5.575
Bridgeport,Conn. N19 ..5.725
Buffalo R2 .....5.575
Canton,O. R2, T7 .....5.575
Clairton,Pa. U5 .....5.575
Detroit R7 .....5.575
Ecorse,Mich. G5 .....5.675
Fontana,Calif. K1 .....6.625
FairlessHills,Pa. U5 ...5.725
Gary,Ind. U5 .....5.575
Houston 85 .....5.825
Ind.Harbor,Ind. I-2,Y1..5.575
Johnstown,Pa. B2 ....5.575
KansasCity,Mo. 85 ....5.825
Lackawanna,N.Y. B2 ..5.575
LosAngeles B3 .....6.625
Massillon,O. R2 .....5.575
Midland,Pa. C18 .....5.575
S.Chicago R2, U5, W14..5.575
S.Duquesne,Pa. U5 ....5.575
Struthers,O. Y1 .....5.575
Warren,O. C17 .....5.575
Youngstown U5 .....5.575

BARS & SMALL SHAPES, H.R. High-Strength Low-Alloy
Aliquippa,Pa. J5 .....6.80
Bessemer,Ala. T2 .....6.80
Bethlehem,Pa. B2 .....6.80
Clairton,Pa. U5 .....6.80
Cleveland R2 .....6.80
Ecorse,Mich. G5 .....6.90
Fairfield,Ala. T2 .....6.80
Fontana,Calif. K1 .....7.50
Gary,Ind. U5 .....6.80
Houston 85 .....7.05
Ind.Harb.,Ind. I-2, Y1 ..6.80
Johnstown,Pa. B2 .....6.80
KansasCity,Mo. 85 ....7.05
Lackawanna,N.Y. B2 ...6.80
LosAngeles B3 .....7.50
Pittsburgh J5 .....6.80
Seattle B3 .....7.55
S.Chicago W14 .....6.80
S.Duquesne,Pa. U5 ....6.80
S.SanFrancisco B3 ....7.55
Struthers,O. Y1 .....6.80
Warren,O. R2 .....6.80
Youngstown U5 .....6.80

BAR SIZE ANGLES; H.R. Carbon
Bethlehem,Pa. B2 .....4.80

BAR SIZE ANGLES; S. Shapes
Aliquippa,Pa. J5 .....4.65
Atlanta A11 .....4.85
Fontana,Calif. K1 .....5.35
Niles,Calif. P1 .....5.00
Pittsburgh J5 .....4.30
Portland,Oreg. O4 .....5.05
SanFrancisco 87 .....5.05

BAR SHAPES, Hot-Rolled Alloy
Clairton,Pa. U5 .....5.65
Gary,Ind. U5 .....5.65
Houston 85 .....5.90
KansasCity,Mo. 85 ....5.90
Youngstown U5 .....5.65

BARS, C.F. Loaded Alloy
Ambridge,Pa. W18 ...8.325
Camden,N.J. P13 .....8.50
Chicago W18 .....8.325
Cleveland C20 .....8.325
Monaca, Pa. S17 ....8.325
Newark,N.J. W18 ....8.50
SpringCity,Pa. K3 ....8.50
Warren,O. C17 .....8.325

BARS, Cold-Finished Carbon
Ambridge,Pa. W18 ....5.90
BeaverFalls,Pa. M12, R2 5.90
Buffalo B5 .....5.95
Camden,N.J. P13 .....6.35
Carnegie,Pa. C12 .....5.90
Chicago W18 .....5.90
Cleveland A7, C20 ....5.90
Detroit R7 .....5.90
Detroit B5, P17 .....6.10
Donora,Pa. A7 .....5.90
Elyria,O. W18 .....5.90
FranklinPark,Ill. N5 ....5.90
Gary,Ind. R2 .....5.90
GreenBay,Wis. F7 .....5.90
Hammond,Ind. L2, M13..5.90
Hartford,Conn. R2 ....6.40
Harvey,Ill. B5 .....5.90
LosAngeles R2, S30 ....7.35
Mansfield,Mass. B5 ....6.45
Massillon,O. R2, R8 ....5.90
Midland,Pa. C18 .....5.90
Monaca,Pa. S17 .....5.90
Newark,N.J. W18 .....6.35
NewCastle,Pa.(17) B4 ..5.90
Pittsburgh J5 .....5.90
Plymouth,Mich. P5 ....6.15
Putnam,Conn. W18 ....6.45
Readville,Mass. C14 ....6.45
S.Chicago,Ill. W14 ....5.90
SpringCity,Pa. K3 ....6.35
Struthers,O. Y1 .....5.90
Waukegan,Ill. A7 .....5.90
Worcester,Mass. W19 ...6.35
Youngstown F3, Y1 ....5.90

BARS, Cold-Finished Carbon (Turned and Ground)
Cumberland,Md. C19 ...5.15

BARS, Cold-Finished Alloy
Ambridge,Pa. W18 ....7.425
BeaverFalls,Pa. M12,R2 7.425
Bethlehem,Pa. B2 .....7.425
Buffalo B5 .....7.425
Camden,N.J. P13 .....7.60
Canton,O. T7 .....7.425
Carnegie,Pa. C12 .....7.425
Chicago W18 .....7.425
Cleveland A7, C20 ....7.425
Detroit R7 .....7.425
Detroit B5, P17 .....7.625
Donora,Pa. A7 .....7.425
Elyria,O. W8 .....7.425
Gary,Ind. R2 .....7.425
GreenBay,Wis. F7 .....7.425
Hammond,Ind. L2, M13..7.425
Hartford,Conn. R2 ....7.725
Harvey,Ill. B5 .....7.425
Lackawanna,N.Y. B2 ..7.425
LosAngeles S30 .....9.10
Mansfield,Mass. B5 ...7.725
Massillon,O. R2, R8 ...7.425
Midland,Pa. C18 .....7.425
Monaca,Pa. S17 .....7.425
Newark,N.J. W18 .....7.60
Plymouth,Mich. P5 ....7.625
S.Chicago W14 .....7.425
SpringCity,Pa. K3 .....7.60
Struthers,O. Y1 .....7.425
Warren,O. C17 .....7.425
Waukegan,Ill A7 .....7.425
Worcester,Mass. A7 ...7.725
Youngstown F3, Y1 ...7.425

BARS, Reinforcing (To Fabricators)
Ala.City,Ala R2 .....4.65
Atlanta A11 .....4.85
Birmingham C15 .....4.65
Buffalo R2 .....4.65
Cleveland R2 .....4.65
Ecorse,Mich. G5 .....4.75
Emeryville,Calif. J7 ....5.40
Fairfield,Ala. T2 .....4.65
FairlessHills,Pa. U5 ....4.80
Fontana,Calif. K1 .....5.35
Ft.Worth,Tex.(42) T4 ...5.10
Gary,Ind. U5 .....4.65
Houston 85 .....4.90

Ind.Harbor,Ind. I-2, Y1 4.65
Johnstown,Pa. B2 ..... 4.65
Joliet,Ill. P22 ..... 4.65
KansasCity,Mo. S5 ..... 4.90
Lackawanna,N.Y. B2 ..... 4.65
LosAngeles B3 ..... 5.35
Milton,Pa. M18 ..... 4.65
Minnequa,Colo. C10 ..... 5.10
Niles,Calif. P1 ..... 5.00
Pittsburg,Calif. C11 ..... 5.35
Pittsburgh J5 ..... 4.65
Portland,Oreg. O4 ..... 5.40
SandSprings,Okla. S5 ..... 5.15
Seattle B3, N14 ..... 5.40
S.Chicago R2 ..... 4.65
S.Duquesne,Pa. U5 ..... 4.65
S.SanFrancisco B3 ..... 5.40
SparrowsPoint,Md. B2 ..... 4.65
Sterling,Ill.(1) N15 ..... 4.65
Sterling,Ill. N15 ..... 4.75
Struthers,O. Y1 ..... 4.65
Torrance,Calif. C11 ..... 5.35
Youngstown R2, U5, Y1 4.65

BARS, Reinforcing (Fabricated; to Consumers)

Johnstown,Pa. ¼-1" B2 6.15
KansasCity,Kans. S5 ..... 6.45
Lackawanna,N.Y. B2 ..... 6.17
Marion,O. P11 ..... 5.90
Pittsburgh U8 ..... 6.17
Seattle B3, N14 ..... 6.60
SparrowsPt. ½-1" B2 ..... 6.15
Williamsport,Pa. S19 ..... 6.00

RAIL STEEL BARS

Avis,Pa.(3) J8 ..... 4.25
ChicagoHts.(3) C2, I-2 ..... 4.55
ChicagoHts.(4) C2, I-2 ..... 4.65
Ft.Worth,Tex.(26) T4 ..... 4.95
Franklin,Pa.(3) F5 ..... 4.55
Franklin,Pa.(4) F5 ..... 4.65
Marion,O.(3) P11 ..... 4.50
Moline,Ill.(3) R2 ..... 4.65
Tonawanda(3) B12 ..... 4.50
Tonawanda(4) B12 ..... 4.65
Williamsport,Pa.(3) S19 4.65

BARS, Wrought Iron

Economy,Pa.(S.R.)B14 11.50
Economy,Pa.(D.R.)B14 14.30
Economy(Staybolt)B14 14.65
McK.Rks.(S.R.) L5 ..... 11.50
McK.Rks.(D.R.) L5 ..... 16.00
McK.Rks.(Staybolt) L5 17.00

SHEETS

SHEETS, Hot-Rolled Steel (18 Gage and Heavier)

Ala.City,Ala. R2 ..... 4.325
Allenport,Pa. P7 ..... 4.325
Ashland,Ky.(8) A10 ..... 4.325
Cleveland J5, R2 ..... 4.325
Conshohocken,Pa. A3 ..... 4.375
Detroit(8) M1 ..... 4.425
Dravosburg,Pa. U5 ..... 4.325
Ecorse,Mich. G5 ..... 4.425
Fairfield,Ala. T2 ..... 4.325
FairlessHills,Pa. U5 ..... 4.375
Fontana,Calif. K1 ..... 5.075
Gary,Ind. U5 ..... 4.325
Geneva,Utah C11 ..... 4.425
GraniteCity,Ill. G4 ..... 4.525
Ind.Harbor,Ind. I-2, Y1 4.325
Kokomo,Ind. C16 ..... 4.425
Lackawanna,N.Y. B2 ..... 4.325
Mansfield,O. E6, (37) 4.325
Munhall,Pa. U5 ..... 4.325
Newport,Ky.(8) N9 ..... 4.325
Niles,O. N12 ..... 4.325
Pittsburg,Calif. C11 ..... 5.025
Pittsburgh J5 ..... 4.325
Portsmouth,O. P12 ..... 4.325
Riverdale,Ill. A1 ..... 4.325
Sharon,Pa. S3 ..... 4.325
S.Chicago Ill. W14 ..... 4.325
SparrowsPoint,Md. B2 4.325
Steubenville,O. W10 ..... 4.325
Warren,O. R2 ..... 4.325
Weirton,W.Va. W6 ..... 4.325
Youngstown U5, Y1 ..... 4.325

SHEETS, H.R. (19 Ga. & Lighter)

Ala.City,Ala. R2 ..... 5.625
Kokomo,Ind. C16 ..... 5.475
Niles,O. N12 ..... 5.325

SHEETS, H.R. Alloy

Ind.Harbor,Ind. Y1 ..... 7.20
Youngstown Y1 ..... 7.20

SHEETS, H.R. (14 Ga. & Heavier) High-Strength Low-Alloy

Cleveland J5, R2 ..... 6.375
Conshohocken,Pa. A3 ..... 6.425
Dravosburg,Pa. U5 ..... 6.375
Ecorse,Mich. G5 ..... 6.475
Fairfield,Ala. T2 ..... 6.375
FairlessHills,Pa. U5 ..... 6.425
Fontana,Calif. K1 ..... 7.125
Gary,Ind. U5 ..... 6.375
Ind.Harbor,Ind. I-2, Y1 6.375
Lackawanna(35) B2 ..... 6.375
Munhall,Pa. U5 ..... 6.375
Pittsburgh J5 ..... 6.375
Sharon,Pa. S3 ..... 6.375
S.Chicago,Ill. U5 ..... 6.375
SparrowsPoint(36) B2 ..... 6.375
Warren,O. R2 ..... 6.375
Weirton,W.Va. W6 ..... 6.375
Youngstown U5, Y1 ..... 6.375

SHEETS, Hot-Rolled Ingot Iron (18 Gage and Heavier)

Ashland,Ky.(8) A10 ..... 4.575
Cleveland R2 ..... 4.925
Ind.Harbor,Ind. I-2 ..... 4.575
Warren,O. R2 ..... 4.925

SHEETS, Cold-Rolled Steel (Commercial Quality)

Allenport,Pa. P7 ..... 5.325
Cleveland J5, R2 ..... 5.325
Conshohocken,Pa. A3 ..... 5.375
Dravosburg,Pa. U5 ..... 5.325
Detroit M1 ..... 5.325
Ecorse,Mich. G5 ..... 5.425
Fairfield,Ala. T2 ..... 5.325
FairlessHills,Pa. U5 ..... 5.375
Follansbee,W.Va. F4 ..... 5.325
Fontana,Calif. K1 ..... 6.425
Gary,Ind. U5 ..... 5.325
GraniteCity,Ill. G4 ..... 5.525
Ind.Harbor,Ind. I-2, Y1 5.325
Lackawanna,N.Y. B2 ..... 5.325
Mansfield,O. E6 ..... 5.325
Middletown,O. A10 ..... 5.325
Newport,Ky. N9 ..... 5.325
Pittsburg,Calif. C11 ..... 6.275
Pittsburgh J5 ..... 5.325
Portsmouth,O. P12 ..... 5.325
SparrowsPoint,Md. B2 ..... 5.325
Steubenville,O. W10 ..... 5.325
Warren,O. R2 ..... 5.325
Weirton,W.Va. W6 ..... 5.325
Youngstown Y1 ..... 5.325

SHEETS, Cold-Rolled High-Strength Low-Alloy

Cleveland J5, R2 ..... 7.875
Dravosburg,Pa. U5 ..... 7.875
Ecorse,Mich. G5 ..... 7.975
FairlessHills,Pa. U5 ..... 7.925
Fontana,Calif. K1 ..... 8.975
Gary,Ind. U5 ..... 7.875
IndianaHarbor,Ind. Y1 7.875
Lackawanna(37) B2 ..... 7.875
Pittsburgh J5 ..... 7.875
SparrowsPoint(38) B2 7.875
Warren,O. R2 ..... 7.875
Weirton,W.Va. W6 ..... 7.875
Youngstown Y1 ..... 7.875

SHEETS, Cold-Rolled Ingot Iron

Cleveland R2 ..... 5.925
Middletown,O. A10 ..... 5.825
Warren,O. R2 ..... 5.925

SHEETS, Culvert (16 Gage)	Cu Alloy	Cu Fe
Ashland,Ky. A10	6.90	...
Canton,O. R2	6.10	6.55
Dravosburg U5	6.10	...
Fairfield T2	6.10	...
Gary,Ind. U5	6.10	6.35
Ind.Harbor I-2	6.10	6.35
Kokomo,Ind. C16	6.20	...
MartinsFry. W10	6.10	...
Newport,Ky. N9	6.10	6.35
Pitts.,Calif. C11	6.85	...
SparrowsPt. B2	6.10	...

SHEETS, Culvert—Pure Iron

Ashland,Ky. A10 ..... 7.15
Gary,Ind. U5 ..... 6.35
MartinsFry,O. W10 ..... 6.35

SHEETS, Galvanized Steel Hot-Dipped

Ala.City,Ala. R2 ..... 5.85‡
Ashland,Ky. A10 ..... 5.85†
Canton,O. R2 ..... 5.85‡
Delphos,O. N16 ..... 6.60‡
Dover,O. R1 ..... 5.85‡
Dravosburg,Pa. U5 ..... 5.85†
Fairfield,Ala. T2 ..... 5.85†
Gary,Ind. U5 ..... 5.85*
GraniteCity,Ill. G4 ..... 6.05
Ind.Harbor,Ind. I-2 ..... 5.85†
Kokomo,Ind. C16 ..... 5.95‡
MartinsFerry,O. W10 ..... 5.85*
Middletown,O. A10 ..... 5.85†
Newport,Ky. N9 ..... 5.85‡
Niles,O. N12 ..... 6.85‡
Pittsburg,Calif. C1 ..... 6.60*
SparrowsPt.,Md. B2 ..... 5.85†
Steubenville,O. W10 ..... 5.85‡
Warren,O. R2 ..... 5.85†
Weirton,W.Va. W6 ..... 5.85*

*Continuous and noncontinuous. †Continuous. ‡Noncontinuous.

SHEETS, Well Casing

Fontana,Calif. K1 ..... 6.575

SHEETS, Galvanized High-Strength Low-Alloy

Dravosburg,Pa. U5 ..... 8.60
SparrowsPoint(39) B2 ..... 8.60

SHEETS, Galvannealed Steel

Canton,O. R2 ..... 6.25
Dravosburg,Pa. U5 ..... 6.25
Kokomo,Ind. C16 ..... 6.60
Newport,Ky. N9 ..... 6.25
Niles,O. N12 ..... 7.25

SHEETS, Galvanized Ingot Iron (Hot-dipped Continuous)

Ashland,Ky. A10 ..... 6.10
Canton,O. R2 ..... 6.60
Middletown,O. A10 ..... 6.10

SHEETS, Electrogalvanized

Cleveland(28) R2 ..... 6.70
Niles,O.(28) R2 ..... 6.70
Weirton,W.Va. W6 ..... 6.55

SHEETS, Aluminum Coated

Butler,Pa. A10 (type 1) 8.50
Butler,Pa. A10 (type 2) 8.60

SHEETS, Enameling Iron

Ashland,Ky. A10 ..... 5.90
Cleveland R2 ..... 5.90
Dravosburg,Pa. U5 ..... 5.90
Gary,Ind. U5 ..... 5.90
GraniteCity,Ill. G4 ..... 6.10
Ind.Harbor,Ind. I-2 ..... 5.90
Middletown,O. A10 ..... 5.90
Niles,O. N12 ..... 5.90
Youngstown Y1 ..... 5.90

BLUED STOCK, 29 Gage

Follansbee,W.Va. F4 ..... 7.75
Ind.Harbor,Ind. I-2 ..... 7.75
Yorkville,O. W10 ..... 7.75

SHEETS, Long Terne Steel (Commercial Quality)

BeechBottom,W.Va. W10 6.25
Gary,Ind. U5 ..... 6.25
Mansfield,O. E6 ..... 6.25
Middletown,O. A10 ..... 6.25
Niles,O. N12 ..... 6.25
Weirton,W.Va. W6 ..... 6.25

SHEETS, Long Terne, Ingot Iron

Middletown,O. A10 ..... 6.65

Key to Producers

A1 Acme Steel Co.
A3 Alan Wood Steel Co.
A4 Allegheny Ludlum Steel
A5 Alloy Metal Wire Co.
A6 American Shim Steel Co.
A7 American Steel & Wire
A8 Anchor Drawn Steel Co.
A9 Angell Nail & Chaplet
A10 Armco Steel Corp.
A11 Atlantic Steel Co.

B1 Babcock & Wilcox Co.
B2 Bethlehem Steel Co.
B3 Beth. Pac. Coast Steel
B4 Blair Strip Steel Co.
B5 Bliss & Laughlin Inc.
B8 Braeburn Alloy Steel
B9 Brainard Steel Div., Sharon Steel Corp.
B10 E. & G. Brooke, Wickwire Spencer Steel Div. Colo. Fuel & Iron
B11 Buffalo Bolt Co., Div., Buffalo-Eclipse Corp.
B12 Buffalo Steel Corp.
B14 A. M. Byers Co.
B15 J. Bishop & Co.

C1 Calstrip Steel Corp.
C2 Calumet Steel Div. Borg-Warner Corp.
C4 Carpenter Steel Co.
C5 Central Iron & Steel Div. Barium Steel Corp.
C7 Cleve. Cold Rolling Mills
C8 Cold Metal Products Co.
C9 Colonial Steel Co.
C10 Colorado Fuel & Iron
C11 Columbia-Geneva Steel
C12 Columbia Steel & Shaft.
C13 Columbia Tool Steel Co.
C14 Compressed Steel Shaft.
C15 Connors Steel Div. H. K. Porter Co. Inc.
C16 Continental Steel Corp.
C17 Copperweld Steel Co.
C18 Crucible Steel Co.
C19 Cumberland Steel Co.
C20 Cuyahoga Steel & Wire
C22 Claymont Steel Products Dept. Wickwire Spencer Steel Division
C23 Charter Wire Inc.
C24 G. O. Carlson Inc.
C31 Chester Blast Furnace Inc.

D2 Detroit Steel Corp.
D3 Detroit Tube & Steel
D4 Disston & Sons, Henry
D6 Driver-Harris Co.
D7 Dickson Weatherproof Nail Co.
D8 Damascus Tube Co.
D9 Wilbur B. Driver Co.

E1 Eastern Gas&Fuel Assoc.
E2 Eastern Stainless Steel
E4 Electro Metallurgical Co.
E5 Elliott Bros. Steel Co.
E6 Empire Steel Corp.

F2 Firth Sterling Inc.
F3 Fitzsimons Steel Co.
F4 Follansbee Steel Corp.
F5 Franklin Steel Div. Borg-Warner Corp.
F6 Fretz-Moon Tube Co.
F7 Ft. Howard Steel & Wire
F8 Ft. Wayne Metals Inc.

G2 Globe Iron Co.
G4 Granite City Steel Co.
G5 Great Lakes Steel Corp.
G6 Greer Steel Co.

H1 Hanna Furnace Corp.
H7 Helical Tube Co.

I-1 Igoe Bros. Inc.
I-2 Inland Steel Co.
I-3 Interlake Iron Corp.
I-4 Ingersoll Steel Div., Borg-Warner Corp.
I-6 Ivins, E., Steel Tube
I-7 Indiana Steel & Wire Co.

J1 Jackson Iron & Steel Co.
J3 Jessop Steel Co.
J4 Johnson Steel & Wire Co.
J5 Jones & Laughlin Steel
J6 Joslyn Mfg. & Supply
J7 Judson Steel Corp.
J8 Jersey Shore Steel Co.

K1 Kaiser Steel Corp.
K2 Keokuk Electro-Metals
K3 Keystone Drawn Steel
K4 Keystone Steel & Wire
K7 Kenmore Metals Corp.

L1 Laclede Steel Co.
L2 LaSalle Steel Co.
L3 Latrobe Steel Co.
L5 Lockhart Iron & Steel
L6 Lone Star Steel Co.
L7 Lukens Steel Co.

M1 McLouth Steel Corp.
M4 Mahoning Valley Steel
M6 Mercer Pipe Div., Sawhill Tubular Products
M8 Mid-States Steel & Wire
M12 Moltrup Steel Products
M13 Monarch Steel Div., Jones & Laughlin Steel Corp.
M14 McInnes Steel Co.
M16 Md. Fine & Special Wire
M17 Metal Forming Corp.
M18 Milton Steel Prod. Div., Merritt-Chapman&Scott

N1 National-Standard Co.
N2 National Supply Co.
N3 National Tube Div.
N5 Nelsen Steel & Wire Co.
N6 NewEng.HighCarb.Wire
N8 Newman-Crosby Steel
N9 Newport Steel Corp.
N12 Niles Rolling Mill Div.
N14 Northwest.SteelRoll.Mills
N15 Northwestern S.&W. Co.
N16 New Delphos Mfg. Co.
N19 Northeastern Steel Corp.

O3 Oliver Iron & Steel Corp.
O4 Oregon Steel Mills

P1 Pacific States Steel Corp.
P2 Pacific Tube Co.
P4 Phoenix Iron & Steel Co.
P5 Pilgrim Drawn Steel
P6 Pittsburgh Coke & Chem.
P7 Pittsburgh Steel Co.
P11 Pollak Steel Co.
P12 Portsmouth Division Detroit Steel Corp.
P13 Precision Drawn Steel
P14 Pitts. Screw & Bolt Co.
P15 Pittsburgh Metallurgical
P16 Page Steel & Wire Div., Amer. Chain & Cable
P17 Plymouth Steel Co.
P19 Pitts. Rolling Mills
P20 Prod. Steel Strip Corp.
P22 Phoenix Mfg. Co.

R1 Reeves Steel & Mfg. Co.
R2 Republic Steel Corp.
R3 Rhode Island Steel Corp.
R5 Roebling's Sons, John A.
R6 Rome Strip Steel Co.
R7 Rotary Electric Steel Co.
R8 RelianceDiv.,EatonMfg.
R9 Rome Mfg. Co.
R10 Rodney Metals Inc.

S1 Seneca Wire & Mfg. Co.
S3 Sharon Steel Corp.
S4 Sharon Tube Co.
S5 Sheffield Steel Div., Armco Steel Corp.
S6 Shenango Furnace Co.
S7 Simmons Co.
S8 Simonds Saw & Steel Co.
S12 Spencer Wire Corp.
S13 Standard Forgings Corp.
S14 Standard Tube Co.
S15 Stanley Works
S17 Superior Drawn Steel Co.
S18 Superior Steel Corp.
S19 Sweet's Steel Co.
S20 Southern States Steel
S23 Superior Tube Co.
S25 Stainless Welded Products
S26 Specialty Wire Co. Inc.
S30 Sierra Drawn Steel Corp.
S40 Seneca Steel Service

T2 Tenn. Coal & Iron Div.
T3 Tenn. Prod. & Chem.
T4 Texas Steel Co.
T5 Thomas Strip Division, Pittsburgh Steel Co.
T6 Thompson Wire Co.
T7 Timken Roller Bearing
T9 Tonawanda Iron Div. Am. Rad. & Stan. San.
T13 Tube Methods Inc.

U4 Universal-Cyclops Steel
U5 United States Steel Corp.
U6 U. S. Pipe & Foundry
U7 Ulbrich Stainless Steels
U8 U. S. Steel Supply Div.

V2 Vanadium-Alloys Steel
V3 Vulcan Crucible Division, H. K. Porter Co. Inc.

W1 Wallace Barnes Co.
W2 Wallingford Steel Co.
W3 Washburn Wire Co.
W4 Washington Steel Corp.
W6 Weirton Steel Co.
W7 W. Va. Steel & Mfg. Co.
W8 West.Auto.Mach.Screw
W9 Wheatland Tube Co.
W10 Wheeling Steel Corp.
W12 Wickwire Spencer Steel Div., Colo. Fuel & Iron
W13 Wilson Steel & Wire Co.
W14 Wisconsin Steel Div., International Harvester
W15 Woodward Iron Co.
W18 Wyckoff Steel Co.
W19 Worcester Pressed Steel

Y1 Youngstown Sheet&Tube

STRIP

STRIP, Hot-Rolled Carbon

Ala.City,Ala.(27) R2	4.325
Allenport,Pa. P7	4.325
Alton,Ill. L1	4.50
Ashland,Ky.(8) A10	4.325
Atlanta A11	4.525
Bessemer,Ala. T2	4.325
Birmingham C15	4.325
Bridgeport,Conn. N19	4.625
Buffalo(27) R2	4.325
Conshohocken,Pa. A3	4.375
Detroit M1	4.425
Ecorse,Mich. G5	4.425
Fairfield,Ala. T2	4.325
Fontana,Calif. K1	5.075
Gary,Ind. U5	4.325
Ind.Harbor,Ind. I-2, Y1	4.325
Johnstown,Pa.(25) B2	4.325
Lackaw'na,N.Y.(24) B2	4.325
LosAngeles(25) B3	5.075
Milton,Pa. M18	4.325
Minnequa,Colo. C10	5.425
NewBritain(10) S15	4.325
N.Tonawanda,N.Y. B11	4.325
Pittsburg,Calif. C11	5.075
Portsmouth,O. P12	4.325
Riverdale,Ill. A1	4.325
SanFrancisco S7	5.05
Seattle(25) B3	5.325
Seattle N14	5.40
Sharon,Pa. S3	4.325
S.Chicago,Ill. W14	4.325
S.SanFrancisco(25) B3	5.075
SparrowsPoint,Md. B2	4.325
Sterling(1) N15	4.325
Sterling,Ill. N15	4.425
Torrance,Calif. C11	5.075
Warren,O. R2	4.325
Weirton,W.Va. W6	4.325
Youngstown U5	4.325

STRIP, Hot-Rolled Alloy

Bridgeport,Conn. N19	7.50
Carnegie,Pa. S18	7.20
Fontana,Calif. K1	8.85
Gary,Ind. U5	7.20
Ind.Harbor,Ind. Y1	7.20
LosAngeles B3	8.40
Newport,Ky. N9	7.20
Sharon,Pa. S3	7.20
S.Chicago W14	7.20
Youngstown U5, Y1	7.20

STRIP, Hot-Rolled High-Strength Low-Alloy

Bessemer,Ala. T2	6.425
Conshohocken,Pa. A3	6.425
Ecorse,Mich. G5	6.525
Fairfield,Ala. T2	6.425
Fontana,Calif. K1	7.525
Gary,Ind. U5	6.425
Houston S5	6.675
Ind.Harbor,Ind. I-2, Y1	6.425
KansasCity,Mo. S5	6.675
Lackawanna,N.Y. B2	6.425
LosAngeles(25) B3	7.175
Seattle(25) B3	7.425
Sharon,Pa. S3	6.425
S.SanFrancisco(25) B3	7.175
SparrowsPoint,Md. B2	6.425
Warren,O. R2	6.425
Weirton,W.Va. W6	6.425
Youngstown U5, Y1	6.425

STRIP, Hot-Rolled Ingot Iron

Ashland,Ky.(8) A10	4.575
Warren,O. R2	4.925

STRIP, Cold-Rolled Carbon

Anderson,Ind. G6	6.25
Baltimore T6	6.25
Boston T6	6.80
Buffalo S40	6.25
Cleveland J5	6.45
Cleveland A7	6.25
Conshohocken,Pa. A3	6.30
Dearborn,Mich. D3	6.35
Detroit D2, M1, P20	6.35
Dover,O. G6	6.25
Ecorse,Mich. G5	6.35
Follansbee,W.Va. F4	6.25
Fontana,Calif. K1	8.00
FranklinPark,Ill. T6	6.35
Ind.Harbor,Ind. I-2	6.35
Ind.Harbor,Ind. Y1	6.45
Indianapolis C8	6.40
Lackawanna,N.Y. B2	6.25
LosAngeles C1	8.50
NewBedford,Mass. R10	6.70
NewBritain(10) S15	6.25
NewCastle,Pa. B4, E5	6.25
NewHaven,Conn. A7	7.00
NewHaven,Conn. D2	6.70
NewKensington,Pa. A6	6.25
Pawtucket,R.I. R3	6.90
Pawtucket,R.I. N8	6.80
Pittsburgh J5	6.45
Portsmouth,O. P12	6.25
Riverdale,Ill. A1	6.35
Rome,N.Y.(32) R6	6.25
Sharon,Pa. S3	6.25
SparrowsPt.,Md. B2	6.25
Trenton,N.J. A13	6.25
Warren,O. R2	6.25
Weirton,W.Va. W6	6.25
Worcester,Mass. A7	7.10
Youngstown Y1	6.45
Youngstown C8	6.25

STRIP, Cold-Rolled Alloy

Boston T6	13.80
Carnegie,Pa. S18	13.45
Cleveland A7	13.45
Dover,O. G6	13.45
FranklinPark,Ill. T6	13.45
Harrison,N.J. C18	13.45
Indianapolis C8	13.60
Pawtucket,R.I. N8	13.80
Sharon,Pa. S3	13.45
Worcester,Mass. A7	13.75
Youngstown C8	13.45

STRIP, Cold-Rolled High-Strength Low-Alloy

Cleveland A7	9.10
Dearborn,Mich. D3	9.20
Dover,O. G6	9.30
Ecorse,Mich. G5	9.20

STRIP, Cold-Finished Spring Steel (Annealed)

	0.26-0.40C	0.41-0.60C	0.61-0.80C	0.81-1.05C	1.06-1.35C
Baltimore T6	7.30	9.25	10.80	12.95	15.65
Boston T6	7.55	9.25	10.80	12.95	15.65
Bristol,Conn. W1	...	...	10.80	12.95	....
Carnegie,Pa. S18	...	8.95	10.80	12.65	....
Cleveland A7	7.00	8.95	10.80	12.65	15.35
Cleveland C7	...	8.95	10.80	12.65	15.35
Dearborn,Mich. D3	7.10	9.05	10.60	....	....
Detroit D2	7.10	9.05	10.60	12.75	....
Dover,O. G6	7.00	8.95	10.80	12.65	15.35
Follansbee,W.Va. F4	7.00	8.95	10.80**	....	....
FranklinPark,Ill. T6	7.10	8.95	10.80	12.65	15.35
Harrison,N.J. C18	...	...	10.80	12.95	15.65
Indianapolis C8	7.15	9.10	10.80	12.65	15.35
NewBritain,Conn.(10) S15	7.00	8.95	10.80	12.65	15.35
NewCastle,Pa. B4, E5	7.00	8.95	10.80	12.65	....
NewHaven,Conn. D2	7.45	9.25	10.80	12.95	....
NewKensington,Pa. A6	7.00	8.95	10.80	....	....
New York W3	...	9.25	10.80	12.95	15.65
Pawtucket,R.I. N8	7.55	9.25	10.80	12.95	15.35
Riverdale,Ill. A1	7.10	8.95	10.80	12.65	15.35
Rome,N.Y.(32) R6	7.00	8.95	10.80	12.65	15.35
Sharon,Pa. S3	7.00	8.95	10.80	12.65	15.35
Trenton,N.J. R5	...	9.25	10.80	12.95	15.65
Wallingford,Conn. W2	7.45	9.25	10.80	12.95	15.65
Warren,O. T5	7.00	8.95	10.80	12.65	15.35
Weirton,W.Va. W6	7.00	8.95	10.80	12.65	15.35
Worcester,Mass. T6	7.55	9.25	10.80	12.95	15.65
Worcester,Mass. A7	7.85	9.25	10.80	12.95	15.65
Youngstown C8	7.00	8.95	10.80	12.65	15.35

**0.065 C, max.

Spring Steel (Tempered)

Bristol,Conn. W1	...	...	14.40	17.60	....
Buffalo W12	...	...	14.40	....	....
FranklinPark,Ill. T6	...	...	14.90	18.10	21.50
Harrison,N.J. C18	...	...	14.40	17.60	21.00
NewYork W3	...	...	14.40	17.60	21.00
Trenton,N.J. R5	...	...	14.40	17.60	21.00
Worcester,Mass. A7, T6	...	...	14.40	17.60	21.00
Worcester,Mass. W12	...	...	14.40	....	....
Youngstown C8	...	...	14.75	17.95	21.35

SILICON STEEL

H.R. SHEETS(22 Ga.,cut lengths)	Field	Armature	Electric	Motor	Dynamo
BeechBottom,W.Va. W10	...	...	9.95	10.95	11.85
Brackenridge,Pa. A4	...	...	9.95	10.95	11.85
Mansfield,O. E6	8.40	9.35	9.95	10.95	11.85
Newport,Ky. N9	8.40	9.35	9.95	10.95	11.85
Niles,O. N12	8.40	9.35	9.95	10.95	....
Vandergrift,Pa. U5	...	9.35	9.95	10.95	11.85
Warren,O. R2	8.40	9.35	9.95	10.95	11.85
Zanesville,O. A10	...	9.35	9.95	10.95	11.85

C.R. COILS & CUT LENGTHS, (22 Ga.) Fully Processed ($\frac{1}{2}$c lower)	Field	Armature	Electric	Motor	Dynamo
Brackenridge,Pa. A4	...	...	10.70	11.70	12.60
GraniteCity,Ill. G4	8.80*	9.80*	10.40*	11.40*	....
IndianaHarbor,Ind. I-2	8.60†	9.60*	10.20*	11.20*	....
Vandergrift,Pa. U5	....	10.10†	10.70†	11.70†	12.60†
Vandergrift,Pa. U5	8.60*	9.60*	10.20*	11.20*	12.10*
Warren,O. R2	8.60†	10.10	10.70	11.70	12.60
Zanesville,O. A10	...	10.10	10.70	11.70	12.60

H.R. SHEETS (22 Ga., cut lengths)	Transformer Grade T-72	T-65	T-58	T-52
BeechBottom,W.Va. W10	12.80	13.35	13.85	14.85
Brackenridge,Pa. A4	12.80	....	....	....
Newport,Ky. N9	12.80	....	....	....
Vandergrift,Pa. U5	12.80	13.35	13.85	14.85
Zanesville,O. A10	12.80‡	13.35‡	13.85‡	14.85‡

C.R. COILS & CUT LENGTHS (22 Ga.)	Grain Oriented T-100	T-90	T-80	T-73	T-72
Brackenridge,Pa. A4	....	15.85	17.45	17.95	13.55‡
Butler,Pa. A10	....	....	17.45	17.95	....
Vandergrift,Pa. U5	14.85	15.85	17.45	17.95	13.55
Warren,O. R2	....	....	....	....	13.55‡

*Semiprocessed. †Fully processed only. ‡Coils, annealed, semiprocessed $\frac{1}{2}$c lower. ‡Coils, $\frac{1}{4}$-cent higher.

Sharon,Pa. S3 ....9.30
SparrowsPt.,Md. B2 ....9.30
Lackawanna,N.Y. B2 ....9.10
Sharon,Pa. S3 ....9.10
SparrowsPoint,Md. B2 ....9.10
Warren,O. R2 ....9.10
Weirton,W.Va. W6 ....9.10
Youngstown Y1 ....9.30

STRIP, Electrogalvanized

Cleveland A7	6.25*
Dover,O. G6	6.25*
Riverdale,Ill. A1	6.55*
Youngstown C8	6.25*
Warren,O. T5	6.25*
Warren,O. B9	6.45*
Weirton,W.Va. W6	5.75*
Worcester,Mass. A7	7.10*

*Plus galvanizing extras.

STRIP, Galvanized (Continuous)

Sharon,Pa. S3	6.55

TIGHT COOPERAGE HOOP

Atlanta A11	5.05
Riverdale,Ill. A1	4.90
Sharon,Pa. S3	4.75
Youngstown U5	4.75

TIN MILL PRODUCTS

TIN PLATE Electrolytic (Base Box)	0.25 lb	0.50 lb	0.75 lb
Aliquippa,Pa. J5	$7.90	$8.15	$8.55
Dravosburg,Pa. U5	7.90	8.15	8.55
Fairfield,Ala. T2	8.00	8.25	8.65
FairlessHills,Pa. U5	8.00	8.25	8.65
Gary,Ind. U5	7.90	8.15	8.55
GraniteCity,Ill. G4	8.00	8.25	8.65
IndianaHarbor,Ind. I-2, Y1	7.90	8.15	8.55
Niles,O. R2	7.90	8.15	8.55
Pittsburg,Calif. C11	8.65	8.90	9.30
SparrowsPoint,Md. B2	8.00	8.25	8.65
Weirton,W.Va. W6	7.90	8.15	8.55
Yorkville,O. W10	7.90	8.15	8.55

ELECTROTIN (22-27 Gage; Dollars per 100 lb)			
Aliquippa,Pa. J5	6.575	....	....
Niles,O. R2	7.075	7.275	7.475

TINPLATE, American Coke (Base Box)	1.25 lb	1.50 lb
Aliquippa,Pa. J5	$9.20	$9.45
Dravosburg,Pa. U5	9.20	9.45
Fairfield,Ala. T2	9.30	9.55
Fairless,Pa. U5	9.30	9.55
Gary,Ind. U5	9.20	9.45
Ind.Har. I-2, Y1	9.20	9.45
Pitts.,Calif. C11	9.95	10.20
Sp.Pt.,Md. B2	9.30	9.55
Warren,O. R2	9.20	9.45
Weirton,W.Va. W6	9.20	9.45
Yorkville,O. W10	9.20	9.45

BLACK PLATE (Base Box)	
Aliquippa,Pa. J5	$7.00
Dravosburg,Pa. U5	7.00
Fairfield,Ala. T2	7.10
FairlessHills,Pa. U5	7.10
Gary,Ind. U5	7.00
GraniteCity,Ill. G4	7.10
Ind.Harbor,Ind. I-2, Y1	7.00
Niles,O. R2	7.00
Pittsburg,Calif. C11	7.75
SparrowsPoint,Md. B2	7.10
Warren,O. R2	7.00
Yorkville,O. W10	7.00

HOLLOWARE ENAMELING Black Plate (29 Gage)

Dravosburg,Pa. U5	6.65
Gary,Ind. U5	6.65
GraniteCity,Ill. G4	6.75
Ind.Harbor,Ind. Y1	6.65
Yorkville,O. W10	6.65

MANUFACTURING TERNES (Special Coated; Base Box)

Dravosburg,Pa. U5	$8.70
Gary,Ind. U5	8.70

MANUFACTURING TERNES (Light Coated, 6 lb; Base Box)

Yorkville,O. W10	$9.15

ROOFING SHORE TERNES (8 lb Coated; Base Box)

Gary,Ind. U5	$10.25

WIRE

WIRE, Manufacturers Bright, Low Carbon

AlabamaCity,Ala. R2	6.25
Aliquippa,Pa. J5	6.25
Alton,Ill. L1	6.425
Atlanta A11	6.45
Bartonville,Ill. K4	6.35
Buffalo W12	6.25
Chicago W13	6.25
Cleveland A7	6.25
Crawfordsville,Ind. M8	6.35
Donora,Pa. A7	6.25
Duluth,Minn. A7	6.25
Fairfield,Ala. T2	6.25
Fostoria,O.(34) S1	6.45
Houston S5	6.50
Jacksonville,Fla. M8	6.77
Johnstown,Pa. B2	6.25
Joliet,Ill. A7	6.25
KansasCity,Mo. S5	6.50
Kokomo,Ind. C16	6.35
LosAngeles B3	7.20
Minnequa,Colo. C10	6.50
Monessen,Pa. P7	6.25
Newark 6-8 ga. I-1	6.90
N.Tonawanda B11	6.25
Palmer,Mass. W12	6.55
Pittsburg,Calif. C11	7.20
Portsmouth,O. P12	6.25
Rankin,Pa. A7	6.25
S.Chicago,Ill. R2	6.25
S.SanFrancisco C10	7.20
SparrowsPoint,Md. B2	6.35
Sterling,Ill.(1) N15	6.25
Sterling,Ill. N15	6.35
Struthers,O. Y1	6.25
Waukegan,Ill. A7	6.25
Worcester,Mass. A7	6.55

WIRE, MB Spring, High Carbon

Aliquippa,Pa. J5	7.90
Alton,Ill. L1	8.075
Bartonville,Ill. K4	8.00
Buffalo W12	7.90
Cleveland A7	7.90
Donora,Pa. A7	7.90
Duluth,Minn. A7	7.95
Fostoria,O. S1	7.95
Johnstown,Pa. B2	7.90
LosAngeles B3	8.85
Millbury,Mass.(12) N6	8.20
Minnequa,Colo. C10	8.15
Monessen,Pa. P16	7.90
Muncie,Ind. I-7	8.10
Palmer,Mass. W12	8.20
Pittsburg,Calif. C11	8.85
Portsmouth,O. P12	7.90
Roebling,N.J. R5	8.20
S.Chicago,Ill. R2	7.90
S.SanFrancisco C10	8.85
SparrowsPt.,Md. B2	8.00
Struthers,O. Y1	7.90
Trenton,N.J. A7	8.20
Waukegan,Ill. A7	7.90
Worcester A7,J4,T6,W12	8.20

WIRE, Upholstery Spring

Aliquippa,Pa. J5	7.60
Alton,Ill. L1	7.775
Buffalo W12	7.60
Cleveland A7	7.60
Donora,Pa. A7	7.60
Duluth,Minn. A7	7.60
Johnstown,Pa. B2	7.60
KansasCity,Mo. S5	7.85
LosAngeles B3	8.55
Minnequa,Colo. C10	7.775
Monessen,Pa. P16	7.60
NewHaven,Conn. A7	7.90
Palmer,Mass. W12	7.90
Pittsburg,Calif. C11	8.55
Portsmouth,O. P12	7.60
Roebling,N.J. R5	7.90
S.Chicago,Ill. R3	7.60
S.SanFrancisco C10	8.55
SparrowsPoint,Md. B2	7.70
Struthers,O. Y1	7.60
Trenton,N.J. A7	7.90
Waukegan,Ill. A7	7.60
Worcester,Mass. A7	7.90

WIRE, Fine & Weaving (8" Coils)

Alton,Ill. L1	12.725
Bartonville,Ill. K4	12.65
Buffalo W12	12.55
Chicago W13	12.55
Cleveland A7	12.55
Crawfordsville,Ind. M8	12.65
Fostoria,O. S1	12.55
Jacksonville,Fla. M8	13.00
Johnston,Pa. B2	12.55
Kokomo,Ind. C16	12.55
Minnequa,Colo. C10	12.30
Monessen,Pa. P16	12.55
Muncie,Ind. I-7	12.75
Palmer,Mass. W12	12.55
Roebling,N.J. R5	12.55
S.SanFrancisco C10	12.90
Waukegan,Ill. A7	12.55
Worcester,Mass. A7, T6	12.55

WIRE, Galv'd ACSR for Cores

Bartonville,Ill. K4	10.70
Buffalo W12	10.70
Johnstown,Pa. B2	10.70
Minnequa,Colo. C10	10.825
Monessen,Pa. P16	10.70
Muncie,Ind. I-7	10.90
Pittsburg,Calif. C11	11.50
Portsmouth,O. P12	10.70
Roebling,N.J. R5	11.00
SparrowsPt.,Md. B2	10.80

ROPE WIRE (A)

Bartonville,Ill. K4	10.55
Buffalo W12	10.55
Fostoria,O.(23) S1	10.55
Johnstown,Pa. B2	10.55
Monessen,Pa. P16	10.55
Muncie,Ind. I-7	10.75
Palmer,Mass. W12	10.85
Portsmouth,O. P12	9.75
Roebling,N.J. R5	10.85
SparrowsPt. B2	10.65
Struthers,O. Y1	10.55
Worcester,Mass. J4	10.85

(A) Plow and Mild Plow; add 0.25c for Improved Plow.

WIRE

(Continued)

WIRE, Tire Bead

Bartonville,Ill. K4	14.15
Monessen,Pa. P16	14.20
Roebling,N.J. R5	14.35

WIRE, Cold-Rolled Flat

Anderson,Ind. G6	9.00
Baltimore T6	9.30
Buffalo W12	9.00
Cleveland A7	9.00
Crawfordsville,Ind. M8	9.00
Dover,O. G6	9.00
Fostoria,O S1	9.00
FranklinPark,Ill. T6	9.10
Kokomo,Ind. C16	9.00
Massillon,O R8	9.00
Milwaukee C23	9.20
Monessen,Pa. P16	9.00
Pawtucket,R.I. N8	9.30
Riverdale,Ill. A1	9.10
Rome N.Y. R6	9.00
Trenton,N.J. R5	9.30
Worcester A7, T6, W12	9.30

NAIL, Stock

To Dealers & Mfrs. (7)	Col.
AlabamaCity,Ala. R2	152
Aliquippa,Pa. J5	152
Atlanta A11	154
Bartonville,Ill. K4	154
Chicago,Ill. W13	152
Cleveland A9	157
Crawfordsville,Ind. M8	154
Donora,Pa. A7	152
Duluth,Minn. A7	152
Fairfield,Ala. T2	152
Galveston,Tex. D7	157
Houston,Tex. S5	157
Johnstown,Pa. B2	152
Joliet,Ill. A7	152
KansasCity,Mo. S5	157
Kokomo,Ind. C16	154
Minnequa,Colo. C10	157
Monessen,Pa. P7	152
Pittsburg,Calif. C11	171
Rankin,Pa. A7	152
S.Chicago,Ill. R2	152
SparrowsPt.,Md. B2	154
Sterling,Ill.(1) N15	152
Worcester,Mass. A7	158

NAILS, CUT (100 lb keg)

To Dealers (33)	
Conshohocken,Pa. A3	$9.05
Wheeling,W.Va. W10	9.05

STAPLES, Polished Stock

To Dealers & Mfrs. (7)	Col.
Aliquippa,Pa. J5	152
Atlanta A11	154
Bartonville,Ill. K4	154
Crawfordsville,Ind. M8	154
Donora,Pa. A7	152
Duluth,Minn. A7	152
Fairfield,Ala. T2	152
Johnstown,Pa. B2	152
Joliet,Ill. A7	152
Kokomo,Ind. C16	154
Minnequa,Colo. C10	157
Monessen,Pa. P7	152
Pittsburg,Calif. C11	171
Rankin,Pa. A2	152
SparrowsPt.,Md. B2	154
Sterling,Ill.(1) N15	152
Worcester,Mass. A7	158

TIE WIRE, Automatic Baler (14½ Ga.) (Per 97 lb Net Box)

Coil No. 3150	
AlabamaCity,Ala. R2	$9.35
Bartonville,Ill. K4	9.45
Buffalo W12	9.35
Crawfordsville,Ind. M8	9.46
Donora,Pa. A7	9.35
Duluth,Minn. A7	9.35
Johnstown,Pa. B2	9.35
Joliet,Ill. A7	9.35
Kokomo,Ind. C16	9.45
LosAngeles B3	10.14
Minnequa,Colo. C10	9.60
Pittsburg,Calif. C11	10.43
S.Chicago,Ill. R2	9.35
SparrowsPt., Md. B2	9.45
Sterling,Ill. N15	9.35
Coil No. 6500 Stand.	
AlabamaCity,Ala. R2	$9.65
Bartonville,Ill. K4	9.75
Buffalo W12	9.60
Crawfordsville,Ind. M8	9.75
Donora,Pa. A7	9.65
Duluth,Minn. A7	9.65
Johnstown,Pa. B3	9.65
Joliet,Ill. A7	9.65
Kokomo,Ind. C16	9.75
LosAngeles B3	10.45
Minnequa,Colo. C10	9.90
Pittsburg,Calif. C11	10.13
S.Chicago,Ill. R2	9.65
SparrowsPt.,Md. B2	9.75
Sterling,Ill. N15	9.65
Coil No. 6500 Interim	
AlabamaCity,Ala. R2	$9.70
Bartonville,Ill. K4	9.80
Buffalo W12	9.70
Crawfordsville,Ind. M8	9.80
Donora,Pa. A7	9.70
Duluth,Minn. A7	9.70
Johnstown,Pa. B2	9.70
Joliet,Ill. A7	9.70
Kokomo,Ind. C16	9.80
LosAngeles B3	10.50
Minnequa,Colo. C10	9.95
Pittsburg,Calif. C11	10.50
S.Chicago,Ill. R2	9.70
SparrowsPt.,Md. B2	9.80
Sterling,Ill. N15	9.70

WIRE, Barbed

	Col.
AlabamaCity,Ala. R2	175**
Aliquippa J5	172‡
Atlanta A11	181
Bartonville,Ill. K4	181
Crawfordsville,Ind. M8	181
Donora,Pa. A7	175†
Duluth,Minn. A7	175†
Fairfield,Ala. T2	175†
Houston,Tex. S5	180†
Johnstown,Pa. B2	179*
Joliet,Ill. A7	175†
KansasCity,Mo. S5	180†
Kokomo,Ind C16	177†
Minnequa,Colo. C10	180**
Monessen,Pa. P7	179*
Pittsburg,Calif. C11	195†
Rankin,Pa. A7	175†
S.Chicago,Ill. R2	175**
S.SanFrancisco C10	195**
SparrowsPoint,Md. B2	181*
Sterling,Ill.(1) N15	179*

WOVEN Fence, 9-15 Ga.

	Col.
Ala.City,Ala. R2	162**
Ala.City, 17 ga. R2	241**
Ala.City, 18 ga. R2	251**
Aliq'ppa,Pa.9-14½ga J5	165‡
Atlanta A11	168
Bartonville,Ill. K4	168
Crawfordsville,Ind. M8	168
Donora,Pa. A7	162†
Duluth,Minn. A7	162†
Fairfield,Ala. T2	162†
Houston,Tex. S5	167†
Johnstown,Pa.(43) B2	166
Joliet,Ill. A7	162†
KansasCity,Mo. S5	167†
Kokomo,Ind. C16	164†
Minnequa,Colo. C10	167**
Monessen,Pa. 9 ga. P17	166*
Pittsburg,Calif. C11	185†
Rankin,Pa. A7	162†
S.Chicago,Ill. R2	162**
Sterling,Ill.(1) N15	166*

WIRE (16 Gage)	An'ld Galv. Stone	Stone
Ala.City R2	14.50	16.05**
Bartonville K4	14.60	16.50
Buffalo W12	14.50	....
Cleveland A7	14.50	....
Crawf'dsville M8	14.60	16.50
Fostoria,O. S1	14.60	16.15†
Johnstown B2	14.15	16.40*
Kokomo C16	14.60	16.15†
Minnequa C10	14.75	16.45**
Palmer,MassW12	14.50	16.05*
Pitts.,Calif. C11	14.85	16.40†
S.Chicago R2	14.50	16.05**
SparrowsPt. B2	14.60	16.50*
Sterling(1) N15	14.50	16.45††
Waukegan A7	14.50	16.05†
Worcester A7	14.80	....

WIRE, Merchant Quality

(6 to 8 gage)	An'ld Galv.
Ala.City,Ala. R2	7.40 7.80**
Aliquippa J5	7.40 7.925‡
Atlanta A11	7.50 8.075
Bartonville(48) K4	7.50 8.075
Buffalo W12	7.40 8.80†
Cleveland A7	7.40 ....
Crawfordsville M8	7.50 8.075
Donora,Pa. A7	7.40 7.80†
Duluth,Minn. A7	7.40 7.80†
Fairfield T2	7.40 7.80†
Houston,Tex. S5	7.65 8.05†
Jacksville,Fla.M8	7.90 8.475
Johnstown B2(48)	7.40 7.975*
Joliet,Ill. A7	7.40 7.80†
KansasCity,Mo. S5	7.65 8.05†
Kokomo C16	7.50 7.90†
LosAngeles B3	8.35 8.925*
Minnequa C10	7.65 8.05**
Monessen P7 (48)	7.40 7.975*
Palmer,Mass. W12	7.70 8.10†
Pitts.,Calif., C11	8.35 8.75†
Portsmouth,O. P12	7.40 ....
Rankin A7	7.40 7.80†
S.Chicago R2	7.40 7.80**
S.SanFran. C10	8.35 8.75**
Spar'wsPt.B2(48)	7.50 8.075*
Str'ling(1)(48)	N15 7.40 8.00††
Struthers,O.(48)	Y1 7.40 7.90‡
Worcester,Mass.	A7 7.70 ....

*Based on 12.50c zinc; †5c zinc; ‡10c zinc; ‡‡Less than 10c zinc; **Subject to zinc equalization extras. ††13c zinc.

BALE TIES, Single Loop

	Col.
AlabamaCity,Ala. R2	173
Atlanta A11	175
Bartonville,Ill. K4	175
Crawfordsville,Ind. M8	175
Donora,Pa. A7	173
Duluth,Minn. A7	173
Fairfield,Ala. T2	173
Joliet,Ill. A7	173
Houston S5	175
KansasCity,Mo. S5	175
Kokomo,Ind. C16	175
Minnequa,Colo. C10	175
S.Chicago R2	173
S.SanFran.,Calif. C10	197
SparrowsPoint,Md. B2	175
Sterling,Ill.(1) N15	173

BOLTS, NUTS

CARRIAGE, MACHINE BOLTS

(Base discounts, less case lots, per cent off list, f.o.b. midwestern plants)

4" and shorter:	
½" & smaller diam.	+5
Over 4" through 6":	
½" and smaller diam.	+12
6" and shorter:	
⅝" and ⅝"	+13
¾" and larger	+16
Longer than 6":	
All diameters	+25
Lag bolts, all diams:	
6" and shorter	+2
Over 6" long	+11
Ribbed Necked Carriage	+13
Blank	2
Plow	18
Step, Elevator, Tap and Sleigh Shoe	2
Tire Bolts	12
Boiler & Fitting-Up Bolts	14

NUTS

H.P. and C.P., regular & heavy:	
Square, all sizes	51
H.P., Hex. regular & heavy:	
¾" and smaller	55
⅞" to 1¼", inclusive	55
1⅜" to 1½", inclusive	57
1⅝" and larger	51
C.P. Hex regular & heavy:	
¾" and smaller	55
Larger than ¾"	51
Hot Galv. Nuts (all types):	
¾" or smaller	38
⅞" to 1¼", inclusive	36
Finished Hex Nuts:	
¾" and smaller	55
⅞" and larger	51
Semifinished & Slotted Hex:	
Regular and heavy, ¾" and smaller	55
⅞" and larger	51

STEEL STOVE BOLTS

(F.o.b. plant, per cent off list in packages; plain finish)

3" and shorter:	
⅛" thru ¼" diam, 25,000 to 200,000 pieces	61
Over 200,000 pieces	64
⅜" thru ⅝" diam: 15,000 to 100,000 pieces	61
100,000 or more	64
Longer than 3", any diam: 5000 to 100,000 pieces	61
Over 100,000 pieces	64

RIVETS

F.o.b. Cleveland, and/or freight equalized with Pittsburgh, f.o.b. Chicago, and/or freight equalized with Birmingham except where equalization is too great.

Structural ½-in., larger 9.95
⅞-in. under..List less 32%

BOILER TUBES

Net Base c.l. prices dollars per 100 ft. mill; minimum wall thickness, cut lengths 10 to 24 ft inclusive.

O.D.	B.W. Gage	Seamless H.R.	Seamless C.D.	Elec. Weld H.R.
1	13	....	21.06	20.41
1¼	13	....	24.94	20.44
1½	13	23.31	27.57	22.60
1¾	13	27.54	32.57	26.71
2	13	30.87	36.51	29.93
2¼	13	34.77	41.12	33.72
2½	12	37.73	44.63	36.59
2¾	12	41.57	49.16	40.31
2¾	12	45.00	53.22	43.65
3	12	47.99	56.76	46.54

RAILWAY MATERIALS

	Standard No.	Standard No. 2	Tee Rails All No. 2	Tee Rails 60 lb Under
RAILS				
Bessemer,Pa. U5	4.725	4.625	4.675	5.65
Ensley,Ala. T2	4.725	4.625	...	5.65
Fairfield,Ala. T2	...	...	...	5.65
Gary,Ind. U5	4.725	...	...	...
Huntington,W.Va. W7	...	...	...	5.65
IndianaHarbor,Ind. I-2	4.725	4.625	4.675	...
Johnstown,Pa. B2	...	...	...(16)	5.65
Lackawanna,N.Y. B2	4.725	4.625	...	5.65
Minnequa,Colo. C10	4.725	4.625	...	6.15
Steelton,Pa. B2	4.725	4.625	...	...
Williamsport,Pa. S19	...	...	...	5.65

TIE PLATES

Fairfield,Ala. T2	5.625
Gary,Ind. U5	5.625
Ind.Harbor,Ind. I-2	5.625
Lackawanna,N.Y. B2	5.625
Minnequa,Colo. C10	5.625
Seattle B3	5.775
Steelton,Pa. B2	5.625
Torronce,Calif. C11	5.775

TRACK BOLTS (20) Treated

Cleveland R2	12.40
KansasCity,Mo. S5	12.40
Lebanon,Pa. B2	12.40
Minnequa,Colo. C10	12.40
Pittsburgh O3, P14	12.40
Seattle B3	12.90

AXLES

Ind.Harbor,Ind. S13	7.25
Johnstown,Pa. B2	7.25

JOINT BARS

Bessemer,Pa. U5	5.825
Fairfield,Ala. T2	5.825
Ind.Harbor,Ind. I-2	5.825
Joliet,Ill. U5	5.825
Lackawanna,N.Y. B2	5.825
Minnequa,Colo. C10	5.825
Steelton,Pa. B2	5.825

SCREW SPIKES

Cleveland R2	11.90
Pittsburgh O3	11.90

STANDARD TRACK SPIKES

Fairfield,Ala. T2	7.90
Ind.Harbor,Ind. I-2, Y1	7.90
KansasCity,Mo. S5	7.90
Lebanon,Pa. B2	7.90
Minnequa,Colo. C10	7.90
Pittsburgh J5	7.90
Seattle B3	8.40
S.Chicago,Ill. R2	7.90
Struthers,O. Y1	7.90
Youngstown R3	7.90

METAL POWDER

(Per pound f.o.b. shipping point in ton lots for minus 100 mesh, except as otherwise noted)

	Cents
Sponge iron:	
98+% Fe, annealed	15.25
Unannealed:	
Minus 100 mesh	11.75
Minus 35 mesh	9.25
Minus 20 mesh	9.00
Swedish, c.i.f. Camden, N. J., c.l. in bags	*9.50*
Domestic (Swedish), f.o.b. Riverton, N.J., in bags	9.50
Canadian, f.o.b. shipping point	9.50
Electrolytic iron:	
Melting stock, 99.9% Fe, irregular fragments of ⅛ in. x 1.3 in.	*22.00*
Annealed, 99.5% Fe	36.50
Unannealed (99+% Fe)	32.50
Unannealed (99+% Fe) (minus 325 mesh)	52.00
Powder Flakes (minus 16, plus 100 mesh)	31.00
Carbonyl Iron: 97.9-99.8% size 5 to 10 microns	83.00-148.00
Aluminum:	
Atomized, 500 lb drum, frght. allowed	
Carlots	*34.50*
Ton lots	*36.50*
Antimony, 500 lb lots	32.00*
Brass, 5000-lb lots	*38.00-50.00†*
Bronze, 5000-lb lots	*61.50-64.75†*
Copper:	
Electrolytic	13.75*
Reduced	13.75*
Lead	7.50*
Manganese:	
Minus 35 mesh	61.00
Minus 100 mesh	67.00
Minus 200 mesh	72.00
Nickel, unannealed	94.00
Nickel-Silver, 5000-lb lots	*58.75-62.75†*
Phosphor-Bronze, ¼-ton lots	58.50
Silicon	43.50
Solder	7.00*
Stainless Steel, 302	94.00
Stainless Steel, 316	81.25
Tin	14.50*
Zinc, 5000-lb lots	*18.75-32.50‡*
Tungsten	Dollars
Melting grade, 99% 60 to 200 mesh:	
1000 lb and over	4.50
Less than 1000 lb.	4.65
Chromium, electrolytic 99.2% Cr min.	3.50

*Plus cost of metal. †Depending on composition. ‡Depending on mesh. §70% Cu, 20% Zn, 10% Ni; **84% Cu, 13% Zn, 13% Ni.

Footnotes

(1) Chicago Base.
(2) Angles, flats, bands.
(3) Merchant.
(4) Reinforcing.
(5) Chicago or Birm. base.
(7) To jobbers, 3 cols. lower.
(8) 16 Ga. and heavier.
(10) Pittsburgh base.
(11) Cleveland & Pitts. base.
(12) Worcester, Mass., base.
(13) Add 0.25c for 17 Ga. & heavier.
(14) Gage 0.143 to 0.249 in.; for gage 0.142 and lighter, 5.80c.
(15) ⅝" and thinner.
(16) 40 lb and under.
(17) Flats only; 0.25 in. & heavier.
(18) To dealers.
(19) Chicago & Pitts. base.
(20) 0.25 off for untreated.
(21) New Haven, Conn., base.
(22) Deld San Francisco Bay area.
(23) Mild plow, 10.55c.
(24) Deduct 0.10c, finer than 15 Ga.
(25) Bar mill bands.
(26) Delivered in mill zone, 5.10c.
(27) Bar mill sizes.
(28) Bonderized.
(29) Youngstown base.
(30) Sheared; for universal mill add 0.45c for carbon, add 0.40c for alloy and 0.45c H.S.-L.A.
(31) Widths over ⅝-in.; 6.90c for widths ⅝-in. and under by 0.125 in. and thinner.
(32) Buffalo base.
(33) To jobbers, deduct 30c.
(34) 9.60c for cut lengths.
(35) 72" and narrower.
(36) 54" and narrower.
(37) 12 Ga. & heavier; 60" & narrower.
(38) 14 Ga. & lighter; 48" & narrower.
(39) 48" and narrower.
(40) Lighter than 0.035"; 0.035" and heavier, 0.35c higher.
(41) 9.10c for cut lengths.
(42) Mill lengths, f.o.b. mill; deld. in mill zone or within switching limits, 5.25c.
(43) 9-14½ Ga.
(48) 8-7 Ga.

SEAMLESS STANDARD PIPE, Threaded and Coupled

Carload discounts from list, %

Size—Inches	2		2½		3		3½		4		5		6	
List Per Ft	37c		58.5c		76.5c		92c		$1.09		$1.48		$1.92	
Pounds Per Ft.	3.68		5.82		7.62		9.20		10.89		14.81		19.18	
	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*
Aliquippa, Pa. J5	6.5	+10	10.5	+7.25	13	+4.75	14.5	+3.25	14.5	+3.25	14	+3.75	16.5	+1.25
Ambridge, Pa. N2	6.5	..	10.5	...	13	...	14.5	...	14.5	...	14	...	16.5	...
Lorain, O. N3	6.5	+10	10.5	+7.25	13	+4.75	14.5	+3.25	14.5	+3.25	14	+3.75	16.5	+1.25
Youngstown Y1	6.5	+10	10.5	+7.25	13	+4.75	14.5	+3.25	14.5	+3.25	14	+3.75	16.5	+1.25

ELECTRIC WELD STANDARD PIPE, Threaded and Coupled

Carload discounts from list, %

Youngstown R2	6.5	+10	10.5	+7.25	13	+4.75	14.5	+3.25	14.5	+3.25	14	+3.75	16.5	+1.25

BUTTWELD STANDARD PIPE, Threaded and Coupled

Carload discounts from list, %

Size—Inches	⅛		¼		⅜		½		¾		1		1¼	
List Per Ft	5.5c		6c		6c		8.5c		11.5c		17c		23c	
Pounds Per Ft	0.24		0.42		0.57		0.85		1.13		1.68		2.28	
	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*
Aliquippa, Pa. J5	...	...	....	....	....	....	17.5	0.25	20.5	4.25	23	7.75	25.5	9
Alton, Ill. L1	...	...	....	....	....	....	15.5	+1.75	18.5	2.25	21	5.75	23.5	7
Benwood, W. Va. W10..	16.5	+12	7.25	+18.25	+1.75	+26.25	17.5	0.25	20.5	4.75	23	7.75	25.5	7
Butler, Pa. F6	17.5	+11	9	+16.5	0.5	+24	...	...	...	...	...	...	...	...
Etna, Pa. N2	...	...	....	....	....	....	17.5	0.25	20.5	4.25	23	7.75	25.5	9
Fairless Hills, Pa. N3	...	...	....	....	....	....	15.5	+1.75	18.5	2.75	21	5.75	23.5	7
Fontana, Calif. K1	...	...	....	....	....	....	6	+11.25	9	+7.25	11.5	+3.75	14	+2.5
Ind. Harbor, Ind. Y1	...	...	....	....	....	....	16.5	+0.75	19.5	3.25	22	6.75	24.5	8
Lorain, O. N3	...	...	....	....	....	....	17.5	0.25	20.5	4.25	23	7.75	25.5	9
Sharon, Pa. S4	17.5	+11	9	+16.5	0.5	+24	...	...	...	...	...	...	...	...
Sharon, Pa. M6	...	...	....	....	....	....	17.5	0.25	20.5	4.25	23	7.75	25.5	9
Sparrows Pt., Md. B2	15.5	+13	7	+18.5	+1.5	+26	15.5	+1.75	18.5	2.25	21	5.75	23.5	7
Youngstown R2, Y1	...	...	....	....	....	....	17.5	0.25	20.5	4.25	23	7.75	25.5	9
Wheatland, Pa. W9	17.5	+11	9	+16.5	0.5	+24	17.5	0.25	20.5	4.25	23	7.75	25.5	9

Size—Inches	1¼		2		2½		3		3½		4	
List Per Ft	27.5c		37c		58.5c		76.5c		92c		$1.09	
Pounds Per Ft	2.73		3.68		5.82		7.62		9.20		10.89	
	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*
Aliquippa, Pa. J5	26	10	26.5	10.5	28	10.75	28	10.75	....	....	....	....
Alton, Ill. L1	24	8	24.5	8.5	26	8.75	26	8.75	....	....	....	....
Benwood, W. Va. W10...	26	10	26.5	10.5	28	10.75	28	10.75	18.5	0.75	18.5	0.75
Etna, Pa. N2	26	10	26.5	10.5	28	10.75	28	10.75	18.5	0.75	18.5	0.75
Fairless Hills, Pa. N3....	24	8	24.5	8.5	26	8.75	26	8.75	16.5	+1.25	16.5	+1.25
Fontana, Calif. K1	14.5	+1.5	15	+1	16.5	+0.75	16.5	+0.75	7	+10.75	7	+16.75
Ind. Harbor, Ind. Y1	25	9	25.5	9.5	27	9.75	27	9.75	17.5	+0.25	17.5	+0.25
Lorain, O. N3	26	10	26.5	10.5	28	10.75	28	10.75	....	....	....	....
Sharon, Pa. M6	26	10	26.5	10.5	28	10.75	28	10.75	....	....	....	....
Sparrows Pt., Md. B2 ...	24	8	24.5	8.5	26	8.75	26	8.75	16.5	+1.25	16.5	+1.25
Youngstown R2, Y1	26	10	26.5	10.5	28	10.75	28	10.75	18.5	0.75	18.5	0.75
Wheatland, Pa. W9	26	10	26.5	10.5	28	10.75	28	10.75	18.5	0.75	18.5	0.75

*Galvanized pipe discounts based on current price of zinc (13.00c, East St. Louis).

Stainless Steel

Representative prices, cents per pound; subject to current lists of extras

AISI Type	Rerolling Ingots	Rerolling Slabs, Billets	Forging Billets	Seamless Tube Billets	Shapes; H.R. & C.F. Bars; H.R. Strip	Shapes; H.R. & C.F. Bars; Wire	Plates	Sheets	C.R. Strip; Flat Wire
201	17.00	21.50	....	....	31.00	....	....	42.25	39.00
202	18.25	24.00	31.00	36.25	33.50	36.75	38.75	42.50	42.50
301	17.75	22.25	....	36.75	32.00	38.00	....	44.25	41.00
302	19.00	24.75	32.00	37.25	34.50	38.25	40.25	44.50	44.50
302B	20.25	26.50	33.00	37.25	37.75	38.25	40.25	47.00	47.00
303	....	26.75	34.75	40.00	....	41.00	....	....	....
304	20.25	26.00	33.75	39.00	37.25	40.25	43.00	47.25	47.25
304L	....	....	38.75	44.00	42.25	45.25	48.00	52.25	52.25
305	21.75	28.25	....	39.50	40.25	40.25	43.50	50.25	50.25
308	22.00	29.00	38.50	44.25	41.25	45.50	49.75	52.00	52.00
309	29.50	38.25	46.75	53.50	53.50	54.75	58.25	67.00	67.00
309S	31.50	41.00	51.00	59.00	58.50	60.25	63.75	74.00	74.00
310	37.25	48.00	62.25	72.25	68.50	73.50	75.25	78.75	78.75
314	....	....	....	....	....	....	75.25	....	....
316	31.50	40.25	51.25	59.50	58.25	60.75	64.00	68.25	68.25
316L	....	....	56.25	64.75	63.25	65.75	69.25	73.25	73.25
317	37.25	48.25	62.75	72.75	73.50	74.50	77.00	83.75	83.75
321	25.00	32.00	38.25	44.00	44.25	45.25	49.25	54.25	54.25
18-8CbTa	29.25	38.00	45.75	52.25	53.25	53.50	58.00	66.50	66.50
403	....	....	28.75	32.75	....	34.00	36.25	....	44.00
405	17.50	23.00	26.75	31.00	32.25	32.00	33.75	42.25	42.25
410	15.00	19.50	25.50	29.50	28.00	30.50	31.75	36.25	36.25
416	....	....	26.00	30.00	....	31.00	....	....	....
420	23.50	30.25	31.00	36.00	37.75	37.25	40.75	56.00	56.00
430	15.25	19.75	26.00	30.00	28.75	31.00	32.25	36.75	36.75
430F	....	....	26.50	30.50	....	31.50	....	....	....
431	16.00	20.50	26.50	30.50	29.75	31.50	33.00	38.00	38.00
446	....	....	35.50	40.50	53.25	42.00	43.25	63.25	63.25

Stainless Steel Producers Are: Allegheny Ludlum Steel Corp.; Alloy Metal Wire Co. Inc.; Alloy Tube Div., Carpenter Steel Co.; American Steel & Wire Div., U. S. Steel Corp.; Armco Steel Corp.; Babcock & Wilcox Co.; Bethlehem Steel Co.; J. Bishop & Co.; G. O. Carlson Inc.; Carpenter Steel Co.; Charter Wire Products Co.; Cold Metal Products Co.; Crucible Steel Co. of America; Damascus Tube Co.; Wilbur B. Driver Co.; Driver-Harris Co.; Eastern Stainless Steel Corp.; Ellwood Ivins Steel Tube Works Inc.; Firth Sterling Inc.; Ft. Wayne Metals Inc.; Globe Steel Tubes Co.; Helical Tube Co.; Indiana Steel & Wire Co.; Ingersoll Steel Div., Borg-Warner Corp.; Jessop Steel Co.; Johnson Steel & Wire Co. Inc.; Joslyn Mfg. & Supply Co.; Kenmore Metals Corp.; Maryland Fine & Specialty Wire Co.; McLouth Steel Corp.; Metal Forming Corp.; McInnes Steel Co.; National-Standard Co.; National Tube Div., U. S. Steel Corp.; Newman-Crosby Steel Co.; Pacific Tube Co.; Page Steel & Tube Div., American Chain & Cable Co. Inc.; Pittsburgh Rolling Mills Inc.; Republic Steel Corp.; Rodney Metals Inc.; Rome Mfg. Co.; Rotary Electric Steel Co.; Sharon Steel Corp.; Sawhill Tubular Products Inc.; Simonds Saw & Steel Co., Specialty Wire Co. Inc.; Spencer Wire Corp.; Stainless Welded Products Inc.; Standard Tube Co.; Superior Steel Corp.; Superior Tube Co.; Timken Roller Bearing Co.; Trent Tube Co.; Tube Methods Inc.; Ulbrich Stainless Steels; United States Steel Corp.; Universal-Cyclops Steel Co.; Wallingford Steel Co.; Washington Steel Corp.

Clad Steel

	Plates, Carbon Base 10%	Plates, Carbon Base 20%	Sheets, Carbon Base 20%
Stainless:			
302	....	....	30.50
304	30.30	36.05	32.50
304-L	32.30	37.95	....
310	41.30	47.00	....
316	35.50	41.40	47.00
316-L	40.00	46.10	....
316-CB	41.15	48.45	....
321	32.00	37.75	37.25
347	34.40	41.40	48.25
405	25.80	33.35	....
410	25.30	32.85	....
430	25.30	32.85	....
Inconel	49.45	65.45	....
Nickel	41.05	55.65	....
Nickel, Low Carbon	43.25	60.05	....
Monel	42.35	56.35	....
Copper*	....	....	46.00

	Strip, Carbon Base—Cold Rolled 10%	Strip, Carbon Base—Cold Rolled Both Sides
Copper*	30.00	38.00

*Deoxidized. Production points: Stainless-clad sheets, New Castle, Ind. I-4; stainless-clad plates, Claymont, Del. C22, Coatesville, Pa. L7, New Castle, Ind. I-4 and Washington, Pa. J3; nickel, inconel, monel-clad plates, Coatesville L7; copper-clad strip, Carnegie, Pa. S18.

Tool Steel

Grade	$ per lb	Grade	$ per lb
Regular carbon	0.275	5%Cr Hot Work	0.430-0.460
Extra Carbon	0.330	W-Cr Hot Work	0.450
Special Carbon	0.390	V-Cr Hot Work	0.470
Oil Hardening	0.430	Hi-Carbon-Cr	0.770

Grade by Analysis (%)

W	Cr	V	Co	Mo	$ per lb
20.25	4.25	1.6	12.25	...	4.090
18.25	4.25	1	4.75	...	2.305-2.475
18	4	2	9	...	2.675-2.6775
18	4	2	....	...	1.765
18	4	1	....	...	1.600
13.75	3.75	2	5	...	2.245
13.5	4	3	....	...	1.865
9	3.5	...	....	...	1.180
6	4	2	....	5	1.105
6	4	3	....	6	1.350
1.5	4	1	....	8.5	0.960

Tool steel producers include: A4, A8, B2, B8, C4, C9, C13, C18, D4, F2, J3, M14, S8, U4, V2 and V3.

Pig Iron

F.o.b. furnace prices in dollars per gross ton, as reported to STEEL. Minimum delivered prices are approximate and do not include 3% federal tax.

	Basic	No. 2 Foundry	Malleable	Bessemer
Birmingham District				
AlabamaCity,Ala. R2	54.50	55.00‡	....	....
Birmingham R2	54.50	55.00‡	....	....
Birmingham U6	....	55.00‡	59.00	....
Woodward,Ala. W15	54.50	55.00‡	59.00	....
Cincinnati, deld.	....	62.70	....	....
Buffalo District				
Buffalo H1, R2	58.50	59.00	59.50	60.00
Tonawanda,N.Y. W12	58.50	59.00	59.50	60.00
N.Tonawanda,N.Y. T9	....	59.00	59.50	60.00
Boston, deld.	69.15	69.65	70.15	....
Rochester,N.Y. deld.	61.52	62.02	62.52	....
Syracuse,N.Y. deld.	62.62	63.12	63.62	....
Chicago District				
Chicago I-3	58.50	59.00	59.00	59.50
Gary,Ind. U5	58.50	....	59.00	....
S.Chicago R2	58.50	....	59.00	....
S.Chicago,Ill. Y1	58.50	59.00	59.00	59.50
S.Chicago,Ill. U5, W14	58.50	....	59.00	59.50
Milwaukee, deld.	60.67	61.17	61.17	61.67
Muskegon,Mich. deld.	....	65.30	65.30	....
Cleveland District				
Cleveland A7, R2	58.50	59.00	59.00	59.50
Akron,O., deld.	61.25	61.75	61.75	62.25
Lorain,O. N3	58.50	....	....	59.50
Mid-Atlantic District				
Bethlehem,Pa. B2	60.50	61.00	61.50	62.00
NewYork, deld.	....	64.78	65.28	....
Newark, deld.	63.52	64.02	64.52	65.02
Birdsboro,Pa. B10	60.50	61.00	61.50	62.00
Chester,Pa. C31	54.50	55.00	55.50	....
Philadelphia, deld.	56.16	56.66	57.16	....
Steelton,Pa. B2	60.50	61.00	61.50	62.00
Swedeland,Pa. A3	60.50	61.00	61.50	62.00
Philadelphia, deld.	62.16	62.66	63.16	63.66
Troy,N.Y. R2	60.50	61.00	61.50	62.00
Pittsburgh District				
NevilleIsland,Pa. P6	58.50	59.00	59.00	....
Pittsburgh (N&S sides), Aliquippa, deld.	....	60.37	60.37	60.87
McKeesRocks, deld.	....	60.04	60.04	60.54
Lawrenceville,Homestead, Wilmerding,Monaca, deld.	....	60.66	60.66	61.16
Verona,Trafford, deld.	60.69	61.19	61.19	61.69
Brackenridge, deld.	60.95	61.45	61.45	61.95
Bessemer,Pa. U5	58.50	....	59.00	59.50
Clairton,Rankin,S.Duquesne,Pa. U5	58.50	....	....	....
McKeesport,Pa. N3	58.50	....	....	59.50
Midland,Pa. C18	58.50	....	....	....

Youngstown District	Basic	No. 2 Foundry	Malleable	Bessemer
Hubbard,O. Y1	....	....	59.00	....
Sharpsville,Pa. S6	58.50	....	59.00	59.50
Youngstown Y1	....	....	59.00	59.50
Youngstown U5	58.50	....	....	59.50
Mansfield,O., deld.	63.40	....	63.90	64.40
Duluth I-3	58.50	59.00	59.00	59.50
Erie,Pa. I-3	58.50	59.00	59.00	59.50
Everett, Mass. E1	*62.00*	*62.50*	*63.00*	....
Fontana,Calif. K1	64.50	65.00	....	....
Geneva,Utah C11	58.50	59.00	....	....
GraniteCity,Ill. G4	60.40	60.90	61.40	....
Ironton,Utah C11	58.50	59.00	....	....
LoneStar,Texas L6	....	55.00*	....	....
Minnequa,Colo. C10	60.50	61.00	61.50	....
Rockwood,Tenn. T3	....	55.00‡	59.00	....
Toledo,O. I-3	58.50	59.00	59.00	59.50
Cincinnati, deld.	64.26	64.76	....	....

*Phos. 0.51-0.75%; $56, Phos. 0.31-0.50%.
‡Intermediate (Phos. 0.31-0.69%), $56.

PIG IRON DIFFERENTIALS

Silicon: Add 50 cents per ton for each 0.25% Si or percentage thereof over base grade, 1.75-2.25%, except on low phos iron on which base is 1.75-2.00%.

Manganese: Add 50 cents per ton for each 0.50% manganese over 1% or portion thereof.

Nickel: Under 0.05% no extra; 0.50-0.74%, inclusive, add $2 per ton and each additional 0.25%, add $1 per ton.

BLAST FURNACE SILVERY PIG IRON, Gross Ton

(Base 6.00-6.50% silicon; add $1 for each 0.5% Si; 75 cents for each 0.50% Mn over 1%)

Jackson,O. G2, J1	$67.50
Buffalo H1	68.75

ELECTRIC FURNACE SILVERY IRON, Gross Ton

(Base 14.01-14.50% silicon; add $1 for each 0.5% Si to 18%; $1 for each 0.50% Mn over 1%; $2 per gross ton premium for 0.045% max P)

NiagaraFalls,N.Y. P15	$80.50
Keokuk,Iowa, (Open-hearth & Fdry, freight allowed K2)	87.50
Keokuk, O.H. & Fdry, 12½ lb piglets, 16% Si, frgt allowed K2	90.50

LOW PHOSPHORUS PIG IRON, Gross Ton

Lyles,Tenn. T3 (Phos. 0.035% max)	$72.50
Steelton,Pa. B2 (Phos. 0.035% max)	66.50
Philadelphia, deld.	70.05
Troy,N.Y. R2 (Phos. 0.035% max)	66.50
Cleveland A7 (Intermediate) (Phos. 0.036-0.075% max)	63.50
Duluth I-3 (Intermediate) (Phos. 0.036-0.075% max)	63.50
Erie,Pa. I-3 (Intermediate) (Phos. 0.036-0.075% max)	63.50

Warehouse Steel Products

Representative prices, per pound, subject to extras, f.o.b. warehouse. City delivery charges are 25 cents per 100 lb except: Buffalo, Cleveland, Erie, 30 cents; Moline, Norfolk, Richmond, Washington, 20 cents; Birmingham, Chattanooga, Jackson, 15 cents; Baltimore, Boston, Los Angeles, New York, Philadelphia, Portland, San Francisco, 10 cents; Atlanta, Houston, Seattle, Spokane, no charge.

	SHEETS				STRIP		BARS			Standard Structural Shapes	PLATES	
	Hot-Rolled	Cold-Rolled	Gal. 10 Ga.†	Stainless Type 302	H.R.*	C.R.*	H.R. Rds.	C.F. Rds.‡	H.R. Alloy 4140††[5]		Carbon	Floor
Atlanta	7.14	8.20	8.87	....	7.40	...	7.42	9.39	....	7.63	7.49	9.48
Baltimore	7.03	8.32	9.10	....	7.65	...	7.61	8.62[3]	13.44	7.93	7.21	8.87
Birmingham	6.80	7.90	8.85	....	7.06	...	7.08	9.35	....	7.28	6.99	9.10
Boston	7.70	8.81	10.27	45.67	7.96	...	7.83	9.53	14.45	8.13	7.89	9.36
Buffalo	6.80	8.05	9.77	....	7.15	...	7.10	7.90	13.10	7.40	7.15	8.70
Chattanooga	6.95	8.10	8.60	....	7.20	...	7.20	9.18	....	7.45	7.25	9.05
Chicago	6.80	8.09	8.50	49.05	7.06	...	7.08	7.75	12.85	7.28	6.99	8.46
Cincinnati	6.92	8.08	8.90	46.10	7.30	...	7.32	8.05	13.09	7.75	7.28	8.71
Cleveland	6.80	8.09	8.85	49.16	7.16	...	7.14	7.85	12.91	7.61	7.16	8.63
Detroit	6.99	8.28	8.78	43.50	7.34	...	7.36	8.04	13.05	7.75	7.27	8.65
Erie, Pa.	6.80	7.90	8.85	....	7.15	...	7.08	7.85	....	7.40	7.15	8.63
Houston	7.85	8.75	10.49	....	8.15	...	8.25	9.85	14.00	8.20	7.80	9.20
Jackson, Miss.	7.10	8.20	9.20	....	7.40	...	7.40	9.44	....	7.60	7.45	9.30
Los Angeles	8.05	10.00	11.00	....	8.35	...	8.05	11.25	14.25	8.30	8.05	10.25
Milwaukee	6.89	8.18	8.59	....	7.15	...	7.17	7.94	12.94	7.45	7.08	8.55
Moline, Ill.	7.15	8.28	8.85	....	7.41	...	7.43	8.10	....	7.63	7.34	...
New York	7.46	8.68	9.44	44.95	8.07	...	7.96	9.48	13.28	7.99	7.76	9.19
Norfolk, Va.	7.25	...	...	....	7.65	...	7.65	9.50	....	7.95	7.45	8.95
Philadelphia	7.14	8.42	9.35	45.98	7.67	9.02	7.64	8.46	13.16	7.74	7.37	8.69**
Pittsburgh	6.80	8.09	9.20	49.00	7.16	...	7.08	7.85	12.85	7.28	6.99	8.46
Portland, Oreg.	7.80	8.80	10.65	....	8.00	...	7.95	11.80	15.00	7.85	7.75	9.60
Richmond, Va.	7.00	...	9.47	....	7.65	...	7.70	8.85	....	7.95	7.20	9.10
St. Louis	7.09	8.38	9.19	43.89	7.35	...	7.37	8.14	13.14	7.68	7.28	8.75
St. Paul	7.46	8.59	9.16	....	7.72	...	7.74	8.51	13.51	7.94	7.65	9.12
San Francisco	8.10	9.65	10.15	51.65	8.35	...	8.05	11.20	14.25[3]	8.25	8.05	10.25
Seattle	8.55	10.40	10.80	54.00	8.65	...	8.35	11.70	14.60	8.30	8.20	10.10
Spokane	8.55	11.00[7]	10.80	....	9.05	...	8.35	11.80	15.35	8.30	8.20	10.60
Washington	7.50	8.79	7.97	....	8.12	...	8.08	9.09	....	8.40	7.68	9.34

Prices do not include gage extras; †prices include gage and coating extras (based on 12.50-cent zinc), except in Birmingham (coating extra excluded); ‡includes 35-cent special bar quality extras; **⅛-in. and heavier; ††as annealed; §§under ⅛-in.

Base quantities, 2000 to 4999 lb except as noted; Cold-rolled strip and cold-finished bars, 2000 lb and over except in Seattle, 2000 to 9999 lb, and in Los Angeles, 6000 lb and over; stainless sheets, 8000 lb except in Chicago, New York and Boston, 10,000 lb, and in San Francisco, 2000 to 4999 lb; hot-rolled products on West Coast, 2000 to 9999 lb; [3]—500 to 9999 lb; [5]—400 to 999 lb; [6]—4000 lb and over; [7]—1000 to 1999 lb; [8]—1000 lb and over; [7]—1500 to 3999 lb; [8]—2000 to 3999 lb; [9]—f.o.b. local delivery in lots of 10,000 lb and over.

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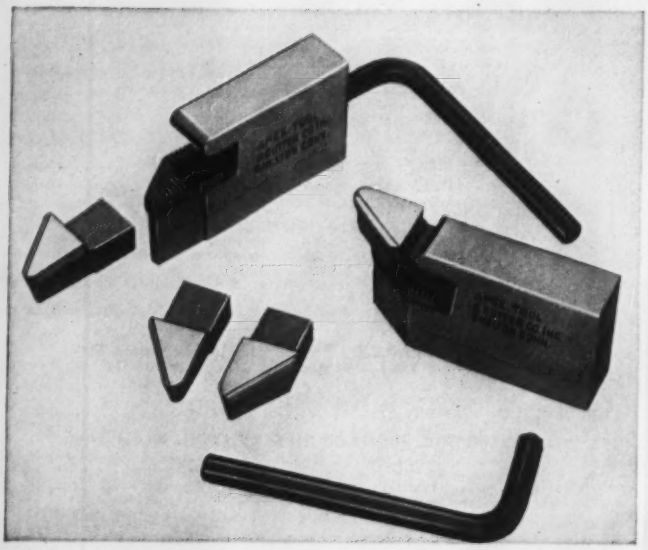

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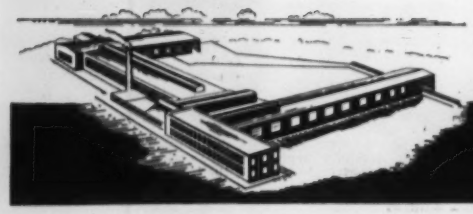

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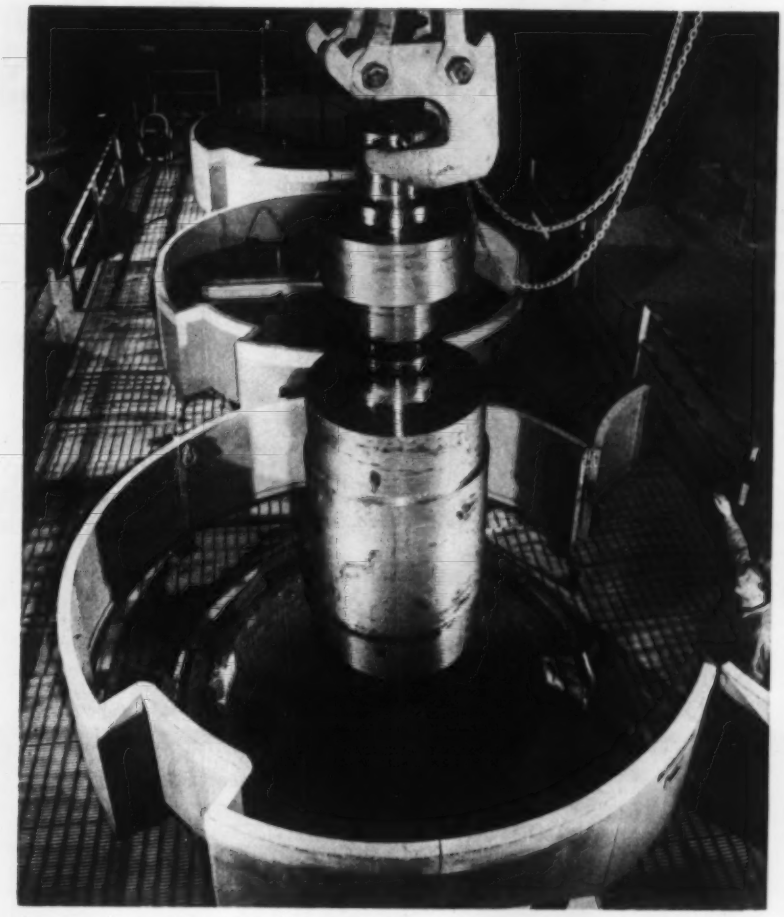

One of three new heat treating furnaces installed in forging division of U. S. Steel Corp.'s Homestead District Works receives a 90-ton generator rotor

Forging Capacity Expanded

U. S. STEEL CORP. is strengthening its position as a supplier of steel forgings. It's expanding its forgings division at its Homestead (Pa.) District Works.

The expansion will round out the Homestead forging division's product lines and increase flexibility for producing special forgings for the armed services, as well as turbine and generator rotors, heavy machinery parts, rolls and sleeves and plant maintenance equipment.

Big Furnaces—The improvement program includes installation of large vertical heat treating furnaces with an adjoining quenching tower. The gas-fired, 30-ft-high furnaces can heat treat 90-ton rotors in a vertical position. The furnaces are controlled automatically.

After forgings are heat treated in the cylindrically shaped furnaces, they are conditioned further by pressure spraying in the quenching tower. Location of the quenching tower adjacent to the furnaces prevents excessive cooling of the forgings in transfer.

Better Tools—In addition to improvements in vertical and horizontal heat treating furnaces, the program includes relocation and alteration of forging presses and installation of heavy-duty machine tools, such as turning and boring lathes, planer millers and vertical boring mills.

The Homestead District Works has produced heavy forgings since 1898. There was a major expansion of facilities during the early part of World War II to increase production of naval armor, ship propulsion shafting and turbine and generator rotors.

U. S. Steel produces forgings at its Gary, Ind., Works also. Its annual steel forging capacities on Jan. 1, 1954, were: Gary, 60,100 tons; and Homestead, 66,000 tons.

More Business—The increased demand this year for steel extends to forgings, too. Shipments of forgings for sale were 20 per cent greater in tonnage in the first half of this year than in the corresponding period of last year. Shipments in the first half of this year totaled 877,906 tons, compared with 732,043 tons in the first half of last year, the U. S. Department of Commerce reports.

Unfilled orders for commercial steel forgings were climbing, too. At the end of June, 1955, they totaled 519,579 tons, a 27 per cent rise over the 409,194 tons at the end of June, 1954.

Plates . .

Plate Prices, Page 266

"Getting plates in the fourth quarter is like getting gold out of Ft. Knox," said a purchasing agent for a large Pittsburgh construction firm last week.

Supply is tighter than at any time this year, with railroads and other large consumers, such as pipe fabricators, raising their fourth quarter requirements. Consumers that had not fully anticipated their needs earlier in the year are most severely pinched.

One eastern mill has opened its books for first quarter tonnage. It may be joined shortly by another. Still other mills, however, are holding off until they can better gage their position. Right now it looks like only one or two mills will enter the new year current with shipments.

All plate mills entered the current quarter behind on commitments. In an effort to become current, some have been rejecting tonnage offered. One maker, for example, still hasn't accepted December shipment tonnage. Only recently it took November delivery orders, which it was confident it could satisfy. Another producer has been having mechanical difficulties since July and has moved cautiously ever since in booking tonnage. Consequently, it may be in better position than other makers to take first quarter orders when it is able to resume full production.

The stringency in supply is heaviest in wide and heavier gages of sheared material. Most fabricators, for instance, are not too badly off for narrow universal stock. Clad plate deliveries extend to nine weeks in the case of some producers in the East.

Current inquiry reflects particularly heavy construction, oil and gas

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requirements, a further gain in machinery and heavy industrial equipment. Jobbers are unable to keep stocks in balance and are pressing the mills for deliveries. Some say they would be satisfied if they could only get the tonnage promised them.

Shipment in January is promised by but one mill on a small part of Navy requirements recently closed. Better than 6000 tons of hull plates are involved. The best delivery other makers offer is February through April, with the bulk of tonnage listed for March shipment.

The Standard Oil Co. which had 70 storage tanks destroyed by fire at its Whiting, Ind., refinery last Aug. 27, has completed plans to build a new field of 20 tanks as partial replacements. Steel plate requirements will approximate 4000 tons. Additional plate tonnage will be needed for a new ultraforming unit, originally projected for 1957 but pushed forward on account of the fire, and replacement of a recently completed hydroformer ruined by the blaze.

Sheets, Strip . . .

Sheet & Strip Prices, Pages 267 & 268

"Soon." That's sheetmakers' answer to consumers' inquiries as to when they will open first quarter books. One midwest mill indicates it is about ready to accept tonnage for that delivery period; several others are expected to resume active booking within the week.

The general expectation is that most makers will have taken action by the middle of this month. However, indications are most sellers will book largely on a month-to-month basis, rather than open books for the entire quarter. By this policy they can keep closer check on commitments. Most mills will enter first quarter with at least three-week arrearages. January production is already earmarked.

A producer of cold-rolled sheets points out that January lead time will be Nov. 15, and says it will be highly important for consumers to get their orders in as soon as possible, well before mid-November.

On certain specialties, particularly electrical sheets and enameling stock, first quarter entries have already been made by some mills. One maker had long since booked through first quarter on stainless steel sheets and strip. This, however, is exceptional.

Now that production of new model automobiles is getting into full swing, demand for cold-rolled sheets in the Midwest is increasingly pressing even though car builders improved their

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Write for illustrated Bulletin No. 79

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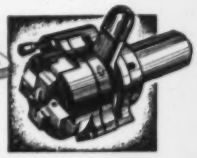

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inventory position the last two months or so. Wide hot-rolled sheets are in almost as tight supply as cold rolled in the area, while year-end carryovers in galvanized, enameling and electrical sheets will exceed a month's production.

New England consumers are unable to get all the sheets they want for first quarter. Estimated requirements include some tonnage for inventory, but orders accepted by the mills barely cover current operating schedules, now largely maintained by delinquent deliveres. There is some evidence in the district that certain sheetmakers are withdrawing from active selling in the area, temporarily at least.

Among the tightest of all products in the Pittsburgh market is cold-rolled strip.

Tin Plate . . .

Tin Plate Prices, Page 268

Higher tin plate prices, announced in August, went into effect Oct. 1. Most consumers have been ordering shipments in volume for some weeks to beat the price increase deadline.

Last week the U. S. Steel Export Co., New York announced increased prices for export, the new bases being concurrent with the changes in domestic quotations. The changes represent an increase of 40 cents per base box, except for special coated manufacturing terne plate, which was advanced 85 cents per base box.

Steel Bars . . .

Bar Prices, Page 266

Hot-rolled carbon bar tonnage is being offered for first quarter shipment. More producers are opening their books for that period, but the general disposition is to book tonnage on a month-to-month basis. For January, it looks like much of that month's production will be taken up in caring for carry-over tonnage from fourth quarter. Despite restrictions on order acceptances over recent weeks, the mills will not likely be able to get their books in balance by the year end.

Demand is pressing from all directions, and the disposition to overbook is prevalent. Indications are supply will be tighter this quarter than earlier in the year.

New England users are placing cold-drawn orders, including leaded grades, for late delivery this year on sizes for which hot-rolled tonnage is available. Converters are fairly well balanced on standard carbon grades, but several that had been turning back delinquent hot-rolled orders are accepting new tonnage sparingly for the first quarter.

In the East, carbon bars in all shapes and sizes are in heavy demand, reflecting widely diversified consuming needs.

Wire . . .

Wire Prices, Pages 268 & 269

Except for fencing and nails, demand for merchant wire products is declining moderately. But the smaller tonnage at mill level in these items is more than offset by heavier requirements for manufacturers wire. Building construction items are holding in strong demand, while highway construction products are at peak for the year.

The wire mills in New England are reported booking heavier volume for the first quarter with demand broadening, except for fine wire specialties, which are inclined to lag. Fourth quarter mill schedules on hard drawn wire are about filled.

Structural Shapes . . .

Structural Shape Prices, Page 266

Inquiry for structural steel continues lively. Although the edge may be off the market slightly because of the advancing building season, there still is a great diversity of tonnage coming out. Also, considerable picking and choosing among fabricators continues to be noted. Some of them are moving more cautiously than formerly in booking orders because of the scarcity of plain material, notably wide flange sections.

Structural contracts in August dropped to 311,453 tons from the previous month's revised total of 369,414 tons, the peak for the year. According to the American Institute of Steel Construction, August was the fourth consecutive month in which bookings exceeded 300,000 tons, and the total for the month showed an increase of 61 per cent over that in the corresponding month a year ago. Cumulative bookings for the first eight months were 37 per cent above those in the like period of 1954, amounting to 2,333,278 tons against 1,697,397 tons.

Shipments in August amounted to 266,715 tons, compared with a revised total of 219,444 in July. Total shipments for the first eight months were 1,900,814 tons, against 2,159,453 in the like period last year, a decline of 12 per cent.

Order backlogs as of Aug. 31 totaled 1,775,625 tons, of which 1,059,898 tons were available for fabrication during the following four-month period.

(Please turn to page 280)

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Standard Ferromanganese: (Mn 74-76%, C 7% approx.) Base price per net ton $190, Clairton, Duquesne, Johnstown and Sheridan, Pa.; Alloy, W. Va.; Ashtabula, Marietta, Philo, O.; Sheffield, Ala.; Portland, Oreg., and Tacoma, Wash. Add or subtract $2.00 for each 1% or fraction thereof of contained manganese over 76% or under 74%, respectively.

(Mn 79-81%). Lump $198 per net ton, f.o.b. Anaconda or Great Falls, Mont. Add $2.60 for each 1% above 81%; subtract $2.60 for each 1% below 76%, fractions in proportion to nearest 0.1%.

Low-Carbon Ferromanganese, Regular Grade: (Mn 85-90%). Carload, lump, bulk, max. 0.07% C, 29.95c per lb of contained Mn, carload packed 30.7c, ton lots 31.8c, less ton 33c. Delivered. Deduct 1.5c for max 0.15% C grade from above prices, 3c for max 0.30% C, 3.5c for max 0.50% C, and 6.5c for max 75% C—max 7% Si. **Special Grade:** (Mn 90% min, C 0.07% max, P 0.06% max). Add 2.05c to the above prices. Spot, add 0.25c.

Medium-Carbon Ferromanganese: (Mn 80-85%, C 1.25-1.5%, Si 1.5% max). Carload, lump, bulk 21.85c per lb of contained Mn, packed, carload 22.9c, ton lot 24.5c, less ton 25.7c. Delivered. Spot, add 0.25c.

Manganese Metal: 2" x D (Mn 95.5% min, Fe 2% max, Si 1% max, C 0.2% max): Carload, lump, bulk, 45c per lb of metal; packed, 45.75c; ton lot 47.25c; less ton lots 49.25c. Delivered. Spot, add 2c.

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Silicomanganese: (Mn 65-68%). Contract, lump, bulk 1.50% C grade, 18-20% Si, 11.2c per lb of alloy. Packed, c.l. 12.2c, ton 12.65c, less ton 13.65c, f.o.b. Alloy, W. Va., Ashtabula, O., Marietta, O., Sheffield, Ala., Portland, Oreg. For 2% C grade, Si 15-17.5%, deduct 0.2c from above prices. For 3% C grade, Si 12-14.5%, deduct 0.4c from above prices. Spot, add 0.25c.

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CHROMIUM ALLOYS

High-Carbon Ferrochrome: Contract, c.l., lump, bulk 26.25c per lb of contained Cr; c.l. packed 27.5c, ton lot 29.25c, less ton 30.65c. Delivered. Spot, add 0.25c.

Low-Carbon Ferrochrome: (Cr 67-71%). Contract, carload, lump, bulk, C 0.025% max (Simplex) 31.75c per lb contained Cr, 0.02 max 38.50c, 0.03 max 38c, 0.06 max 36.50c, 0.1 max 36c, 0.15 max 35.75c, 0.2 max 35.50c, 0.5 max 35.25c, 1.0 max 34c, 1.5 max 33.85c, 2.0 max 33.75c. Ton lot, add 3.1c, less ton add 4.8c. Carload packed add 1.45c. Delivered. Spot add 0.25c.

Foundry Ferrochrome, High-Carbon: (Cr 62-66%, C 5-7%, Si 7-10%). Contract, c.l. 8 M x D, bulk 27.4c per lb contained Cr. Packed c.l. 28.7c, ton 30.5c, less ton 32c. Delivered. Spot, add 0.25c.

Foundry Ferrochrome, Low-Carbon: (Cr 50-54%, Si 28-32%, C 1.25% max). Contract, carloads, packed 8 M x D, 19.6c per lb of alloy, ton lot 20.85c; less ton lot, 22.05c, delivered. Spot, add 0.25c.

Low-Carbon Ferrochrome-Silicon: (Cr 34-41%, Si 42-49%, C 0.05% max). Contract, carload, lump, 4" x down and 2" x down, bulk, 39.05c per lb of contained Cr; 1" x down, bulk 39.8c, Delivered.

Chromium Metal, Electrolytic: Commercial grade (Cr 99.2% min, Fe 0.2 max) Contract, carlot, packed 2" x D plate (about ¼" thick) $1.25 per lb, ton lots $1.27, less ton lots $1.28. Delivered. Spot add 5c.

VANADIUM ALLOYS

Ferrovanadium: Open-hearth Grade (V 50-55%, Si 8% max, C 3% max). Contract, any quantity, $3.10 per lb of contained V. Delivered. Spot, add 10c. **Special Grade** (V 50-55% or 70-75%, Si 2% max, C 0.5% max) $3.20. **High Speed Grade** (V 50-55%, or 70-75%, Si 1.50% max, C 0.20% max) $3.30.

Grainal: Vanadium Grainal No. 1, $1.05 per lb; No. 6, 68c; No. 79, 50c, freight allowed.

Vanadium Oxide: Contract, less carload lots, packed, $1.33 per lb contained V_2O_5, freight allowed. Spot, add 5c.

SILICON ALLOYS

25-30% Ferrosilicon: Contract, carload, lump, bulk, 20.0c per lb of contained Si, packed 21.40c; ton lot 22.50c f.o.b. Niagara Falls, freight not exceeding St. Louis rate allowed.

50% Ferrosilicon: Contract, carload, lump, bulk, 11.75c per lb of contained Si. Packed, c.l. 13.85c, ton lot 15.3c, less ton 16.95c. F.o.b. Alloy, W. Va., Ashtabula, O., Marietta, O., Sheffield, Ala., and Portland, Oreg., Spot, add 0.45c.

Low-Aluminum 50% Ferrosilicon: (Al 0.40% max). Add 1.2c to 50% ferrosilicon prices.

65% Ferrosilicon: Contract, carload, lump, bulk, 14.5c per pound contained silicon. Packed, c.l. 16.2c, ton lots, 18c; less ton, 19.35c. Delivered. Spot, add 0.35c.

75% Ferrosilicon: Contract, carload, lump, bulk, 15.4c per lb of contained Si. Packed c.l. 17.05c, ton lot 18.7c, less ton 19.95c. Delivered. Spot, add 0.3c.

90% Ferrosilicon: Contract, carload, lump, bulk, 18.5c per lb of contained Si. Packed, c.l. 19.95c, ton lot 21.35c, less ton 22.4c. Delivered. Spot, add 0.25c.

Silicon Metal: (Mn 98% Si, 0.75% max Fe, 0.07 max Ca). C.l. lump, bulk, 20.5c per lb of Si. Packed, c.l. 21.95c, ton lot 23.25c, less ton 24.25c. Add 0.5c for max 0.03 Ca grade. Deduct 0.5c for max 2% Fe grade analyzing min 96.5% Si. Spot, add 0.25c.

Alsifer: (Approx. 20% Al, 40% Si, 40% Fe). Contract, basis f.o.b. Niagara Falls, N. Y., lump, carload, bulk, 10.65c per lb of alloy, ton lots packed 11.8c.

ZIRCONIUM ALLOYS

12-15% Zirconium Alloy: (Zr 12-15%, Si 39-43%, C 0.20% max). Contract, c.l. lump, bulk 8.5c, per lb of alloy. Packed, c.l. 9.5c, ton lot 10.65c, less ton 11.5c. Delivered. Spot, add 0.25c.

35-40% Zirconium Alloy: (Zr 35-40%, Si 47-52%, Fe 8-12%, C 0.50% max). Contract, carload, lump, packed 26.25c per lb of alloy, ton lot 27.4c, less ton 28.65c. Freight allowed. Spot, add 0.25c.

BORON ALLOYS

Ferroboron: (B 17.50% min, Si 1.50% max, Al 0.50% max, C 0.50% max). Contract, 100 lb or more 1" x D, $1.20 per lb of alloy. Less than 100 lb $1.30. Delivered, spot add 5c. F.o.b. Washington, Pa., prices, 100 lb and over, are as follows: Grade A (10-14% B) 85c per pound; Grade B (14-18% B) $1.20; Grade C (19% min B) $1.50.

Borosil: (3 to 4% B, 40 to 45% Si). $5.25 per lb contained B, delivered to destination.

Bortam: (B 1.5%-1.9%). Ton lots, 45c per lb; smaller lots, 50c per lb.

Carbortam: (B 1 to 2%). Contract, lump, carloads 9.50c per lb f.o.b. Suspension Bridge, N. Y., freight allowed same as high-carbon ferrotitanium.

CALCIUM ALLOYS

Calcium-Manganese-Silicon: (Ca 16-20%, Mn 14-18% and Si 53-59%). Contract, carload, lump, bulk 22c per lb of alloy, carload packed 23.05c, ton lot 24.95c, less ton 25.95c. Delivered. Spot, add 0.25c.

Calcium-Silicon: (Ca 30-33%, Si 60-65%, Fe 1.5-3%). Contract, carload, lump, bulk 21.5c per lb of alloy, carload packed 22.95c, ton lot 25.25c, less ton 26.75c. Deld. Spot, add 0.25c.

BRIQUETTED ALLOYS

Chromium Briquets: (Weighing approx. 3½ lb each and containing exactly 2 lb of Cr). Contract, carload, bulk, 16.95c per lb of briquet, carload packed in box pallets 17.15, in bags 17.85c; 3000 lb to c.l. in box pallets 18.35c; 2000 lb to c.l. in bags, 19.05c; less than 2000 lb in bags 19.95c. Deld. Add 0.25c for notching. Spot, add 0.25c.

Ferromanganese Briquets: (Weighing approx. 3 lb and containing exactly 2 lb of Mn). Contract, carload, bulk 12.1c per lb of briquet, c.l. packed, pallets 12.3c, bags 13.1c; 3000 lb to c.l., pallets, 13.5c; 2000 lb to c.l., bags, 14.3c, less ton 15.2c. Delivered. Add 0.25c for notching. Spot, add 0.25c.

Silicomanganese Briquets: (Weighing approx. 3½ lb and containing exactly 2 lb of Mn and approx. ½ lb of Si). Contract, c.l. bulk 12.7c per lb of briquet, c.l. packed, pallets, 12.9c; bags 13.7c, 3000 lb to c.l., pallets, 14.1c; 2000 lb to c.l., bags, 14.9c; less ton 15.8c. Delivered. Add 0.25c for notching. Spot, add 0.25c.

Silicon Briquets: (Large size—weighing approx. 5 lb and containing exactly 2 lb of Si). Contract, carload, bulk 6.75c per lb of briquet; packed, pallets, 6.95c; bags, 7.75c; 3000 lb to c.l., pallet, 8.55c; 2000 lb to c.l. bags 9.35c; less ton 10.25c. Delivered. Spot, add 0.25c.
(Small size—Weighing approx. 2½ lb and containing exactly 1 lb of Si). Carload, bulk 6.9c. Packed, pallets 7.1c; bags 7.9c; 3000 lb to c.l. pallets 8.7c; 2000 to c.l. bags 9.5c; less ton 10.4c. Delivered. Add 0.25c for notching, small size only. Spot, add 0.25c.

Molybdic-Oxide Briquets: (Containing 2½ lb of Mo each) $1.14 per pound of Mo contained, f.o.b. Langeloth, Pa.

TUNGSTEN ALLOYS

Ferrotungsten: (70-80%), 5000 lb W or more $3.45 per lb of contained W; 2000 lb W to 5000 lb W, $3.55; less than 2000 lb W, $3.67, delivered.

OTHER FERROALLOYS

Ferrocolumbium: (Cb 56-60%, Si 8% max, C 0.4% max). Contract, ton lot, 2" x D, $6.80-$6.90 per lb of contained Cb. Delivered. Spot, add 10c.

Ferrotantalum—Columbium: (Cb 40% approx., Ta 20% approx., and Cb plus Ta 60% min C 0.30% max). Ton lots, 2" x D, $4.65 per lb of contained Cb plus Ta, deld.; less ton lots $4.70.

Silicaz Alloy: (Si 35-40%, Ca 9-11%, Al 6-8%, Zr 3-5%, Ti 9-11%, B 0.55-0.75%). Carloads packed 1" x D, 45c per lb of alloy, ton lot 47c, less ton 49c. Delivered.

SMZ Alloy: (Si 60-65%, Mn 5-7%, Zr 5-7%, Fe 20% approx.). Contract, c.l. packed, ¼" x 12 M, 18.5c per lb of alloy, ton lots 19.65c, less ton 20.9c. Deld. Spot, add 0.25c.

Graphidox No. 5: (Si 48-52%, Ca 5-7%, Ti 9-11%). C.l. packed, 18.5c per lb of alloy, ton lots 19.65c; less ton lots 20.9c, f.o.b. Niagara Falls, N. Y.; freight allowed to St. Louis.

V-5 Foundry Alloy: (Cr 38-42%, Si 17-19%, Mn 8-11%). C.l. packed 17.2c per lb of alloy; ton lots 18.7c; less ton lots 19.95c, f.o.b. Niagara Falls; freight allowed to St. Louis.

Siminal: (Approx. 20% each Si, Mn, Al; bal, Fe). Lump, carload, bulk 16.50c, Packed c.l. 17.50c, 2000 lb to c.l. 18.50c, less than 2000 lb 19c per lb of alloy. Delivered.

Ferrophosphorus: (23-25% based on 24% P content with unitage of $4 for each 1% of P above or below the base); carloads, f.o.b. sellers' works. Mt. Pleasant, Biglo, Tenn. $90 per gross ton.

Ferromolybdenum: (55-75%). Per lb contained Mo, in 200-lb containers, f.o.b. Langeloth, Pa., $1.46 in all sizes except powdered which is $1.57; Washington, Pa., furnace, any quantity $1.46.

Technical Molybdic-Oxide: Per lb contained Mo, f.o.b. Langeloth, Pa., $1.25 in cans; in bags, $1.24, f.o.b. Langeloth, Pa.; Washington, Pa. $1.24.

(Concluded from page 277)

Reports are heard of construction projects being slowed down by the scarcity of steel.

In New England fabricators' deliveries are being set back by the shortage of steel. Prices on structural steel in place in the area are firmer even though a slight seasonal decline in estimating is in evidence. Area bridge tonnage is heavier, including 7500 tons for Connecticut highways, in addition to 4600 tons on which bids have been taken.

West Coast fabricators report increasing scarcity of wide flange sections and plates.

STRUCTURAL SHAPES . . .

STRUCTURAL STEEL PLACED

3500 tons, grade crossing elimination, Boston & Maine railroad, state project, Salem, Mass., to Groisser & Shlager Iron Works, Somerville, Mass.; Farina Bros., Watertown, Mass., general contractor.

850 tons, potline building, Kaiser Aluminum & Chemical Co., Tacoma, Wash., to Bethlehem Pacific Coast Steel Corp., Seattle.

305 tons, state highway bridges, Plymouth, Mass., to American Bridge Division, U. S. Steel Corp., Pittsburgh; Central Construction Co., Lawrence, Mass., general contractor.

150 tons, 230-kv transmission line for Atomic Energy Commission, Richland, Wash.; reported to American Bridge Division, U. S. Steel Corp., Pittsburgh.

STRUCTURAL STEEL PENDING

7500 tons, superstructure, bridge, Housatonic river, Stratford-Milford, Conn.; bids Oct. 31 at Hartford, Conn.

4165 tons, Weyerhaeuser Lumber Co., pulp mill, Cosmopolis, Wash.

2325 tons, overpass structures, Greenwich-Killingly expressway, Milford, Conn.; DeFalice Co., New Haven, Conn., is low.

2304 tons, superstructure, bridge, Norwalk river, Greenwich-Killingly expressway, Norwalk, Conn.; Klevins Corp., Yonkers, N. Y., is low.

1445 tons, contract P-147, power house addition, Kent Ave., Brooklyn, N. Y., New York City Board of Transportation; Lehigh Structural Steel Co., Allentown, Pa., is low bidder.

1180 tons, power plant addition, 75th St., New York, New York City Board of Transportation; Lehigh Structural Steel Co., Allentown, Pa., is low bidder.

225 tons, substructure, bridge, Norwalk river, and grade separation, Norwalk, Conn.; Mariani Construction Co., New Haven, Conn., is low.

205 tons, bridge, Tolland, Conn.; D. Arrigoni Co., New Haven, Conn., is low.

REINFORCING BARS . . .

REINFORCING BARS PLACED

450 tons, including 65 tons long span joists, for women's dormitory, University of Vermont, Burlington, Vt., to Vermont Structural Steel Co., Burlington; H. P. Cummings Construction Co., Ware, Mass., general contractor.

350 tons, apartment, Rittenhouse Square, Philadelphia, to American Steel Engineering Co., Philadelphia.

131 tons, two state highway jobs (Washington), Thurston and Yakima counties, to Soule Steel Co., Seattle.

180 tons, Thirtieth St. parking area, Pennsylvania Railroad, Philadelphia, to American Steel Engineering Co., that city.

111 tons, two Washington state highway projects, Grays Harbor county, to Bethlehem Pacific Coast Steel Corp., Seattle; Manson Construction Co. and Leavitt & Chandler, Seattle, general contractors.

70 tons, two Washington state highway projects, King and Thurston counties, to Northwest Steel Rolling Mills Inc., Seattle; N. Fiorito Co., Seattle, general contractor.

REINFORCING BARS PENDING

535 tons, Washington state Capitol Lake bridge, Thurston county; bids to Olympia, Wash., Oct. 18.

448 tons, state bridge work, contract 1, Ocean county, N. J.; bids Oct. 18.

100 tons, or more, Idaho state underpass, Latah county; general contract to Walter G. Meyers & Sons, Spokane, Wash., at $56,672.

100 tons, or more, Idaho state Payette river bridge; J. H. Wise & Son, Boise, Idaho, low at $40,416.

PLATES . . .

PLATES PENDING

950 tons, three storage tanks, King Salmon, Alaska, base; Macri Construction Co., Seattle, is low at $1,001,043 to U. S. Engineer.

PIPE . . .

CAST IRON PIPE PENDING

100 tons, 9675 feet of 6 in.; bids to Mukilteo, Wash., Oct. 11.

STEEL PIPE PLACED

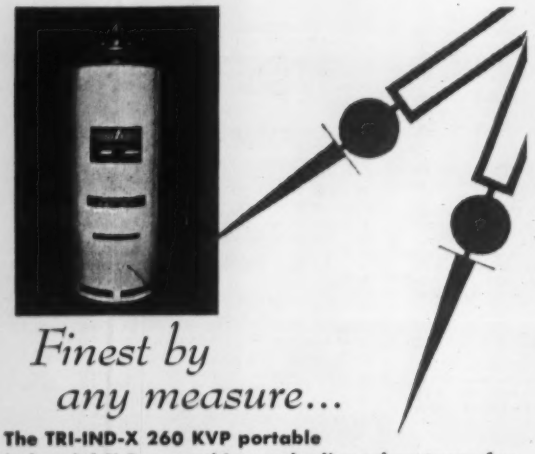
Unstated, 13,500 feet of 6⅝-in. outside diameter, to Beall Pipe & Tank Co., Portland, Oreg., by Portland Gas & Coke Co. for natural gas distribution.

RAILS, CARS . . .

RAILROAD CARS PLACED

Boston & Maine, one lightweight train to American Car & Foundry Division, ACF Industries Inc., New York.

Delaware, Lackawanna & Western, 50 highway trailers for its trailer-on-flatcar piggyback service, to unstated builder.



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The TRI-IND-X 260 KVP portable industrial X-Ray machine embodies advantages far surpassing any other in its field.

Light...Transformer and tube head complete, 65 lbs....A one man carry.

Compact...Tube head, 11" diameter by 36"...Can be operated in restricted space. End ground tube for convenience. **Powerful**...260 KVP and 10 Ma in continuous operation. **Durable**...Tube head shock tested and approved according to MIL specifications.

Carefully engineered in each detail...Tube head perfectly balanced, greatly easing one man manipulation in close quarters; can be operated 400' and more from power supply. Available with interchangeable tubes; either 35° or 360° cones of emission. Master control panel may be placed at any junction in the leads between power unit and transformer tube head.

See...First Time...New, completely self contained, self powered unit that operates any place, anytime on its own gasoline engine...requires no outside connections...Smaller, lighter, yet superior in every way to former models. BOOTH 254, Arena, 37th National Metal Congress and Exposition, Philadelphia.

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Easily-installed units for high-efficiency air movement in all duct systems. Direct-driven types for atmospheres within safe motor operating limits or belted models for hazardous fumes, vapors and excessive temperatures. Sizes 12" to 84" with 2, 4, 6, or 7 blades. Capacities to 120,000 C.F.M.

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Ash and Beale Streets Piqua, Ohio

Ores

Lake Superior Iron Ore
(Prices effective for the 1955 shipping season, gross ton, 51.50% iron natural, rail of vessel, lower lake ports)

Old range bessemer	$10.40
Old range nonbessemer	10.25
Mesabi bessemer	10.25
Mesabi nonbessemer	10.10
Open-hearth lump	11.25
High phosphorus	10.00

Eastern Local Iron Ore
Cents per unit, deld. E. Pa.

Foundry and basic 52-62% concentrates contract	17.00-18.00

Foreign Iron Ore
Cents per unit, c.i.f. Atlantic ports

Swedish basic, 60-68%	20.00
N. African hematite (spot)...nom.	18.00-20.00
Brazilian iron ore, 68-69% (spot)	24.00-26.00

Tungsten Ore
Net ton unit, before duty

Foreign, wolframite, good commercial quality	*$34.50-$35.00*
Domestic, scheelite, mine	63.00

Manganese Ore
Mn 48%, nearby, 95c-$1.05 per long ton unit, c.i.f. U. S. ports, duty for buyer's account; 46-47%, 75c-80c.

Chrome Ore
Gross ton, f.o.b. cars New York, Philadelphia, Baltimore, Charleston, S. C., plus ocean freight differential for delivery to Portland, Oreg., Tacoma, Wash.

Indian and African

48% 2.8:1	nom. $45.00-$50.00
48% 3:1	42.00-44.00
48% no ratio	34.00

South African Transvaal

44% no ratio	$19.00-$20.00
48% no ratio	32.00

Domestic
Rail nearest seller

18% 3:1	$39.00

Molybdenum
Sulphide concentrate, per lb of Mo content, mines, unpacked $1.00

Antimony Ore
Per unit of Sb content, c.i.f. seaboard

55-60%	*$3.60-$3.85*
60-65%	*3.85-4.00*

Vanadium Ore
Cents per lb V_2O_5 content, deld. mills

Domestic	31.00

Refractories

Fire Clay Brick (per 1000)
High-Heat Duty: Ashland, Grahn, Hayward, Hitchins, Haldeman, Olive Hill, Ky., Athens, Troup, Tex., Beech Creek, Clearfield, Curwensville, Lock Haven, Lumber, Orviston, West Decatur, Pa., Bessemer, Ala., Farber, Mexico, St. Louis, Vandalia, Mo., Ironton, Oak Hill, Parral, Portsmouth, O.; Ottawa, Ill., Stevens Pottery, Ga., $122; Salina, Pa., $127; Niles, O., $133.
Super-Duty: St. Louis, $150.

Silica Brick (per 1000)
Standard: Alexandria, Claysburg, Mt. Union, Sproul, Pa., Ensley, Ala., Portsmouth, O., Hawston, Pa., $128; Warren, Niles, O., Hays, Pa., $133; Morrisville, Pa., $131.50; E. Chicago, Ind., Joliet, Rockdale, Ill., $138; Lehigh, Utah, $144; Los Angeles, $151.
Super Duty: Hays, Sproul, Hawston, Pa., Warren, Windham, O., Athens, Tex., $145; Morrisville, Pa., Niles, O., $148; Joliet, Ill., $151; Curtner, Calif., $163.

Semisilica Brick (per 1000)
Clearfield, Pa., $139; Philadelphia, $125; Woodbridge, N. J., $122.

Insulating Fire Brick (per 1000)
2300° *F:* Massillon, O., $178.50; Clearfield, Pa., $213; Augusta, Ga., Beaver Falls, Zelienople, Pa., Mexico, Mo., $206; Vandalia, Mo., $214.10; Portsmouth, O., $207.50; Bessemer, Ala., $212.80.

Ladle Brick (per 1000)
Dry Pressed: Alsey, Ill., Chester, New Cumberland, W. Va., Freeport, Johnstown, Merrill Station, Pa., Mexico, Mo., $88.50; Wellsville, O., $92.50; Clearfield, Pa., Portsmouth, O., $98.

High-Alumina Brick (per 1000)
50 *Per Cent:* Clearfield, Pa., St. Louis, Mexico, Mo., $194; Danville, Ill., $197.
60 *Per Cent:* St. Louis, Mexico, Vandalia, Mo., Clearfield, Pa., $241; Danville, Ill., $244.
70 *Per Cent:* St. Louis, Mexico, Vandalia, Mo., $279; Danville, Ill., $281; Clearfield, Pa., $286.

Sleeves (per 1000)
Reesdale, Johnstown, Bridgeburg, Pa., $157; Clearfield, Pa., $158.50; St. Louis, $169.30.

Nozzles (per 1000)
Reesdale, Pa., $253.70; Johnstown, Pa., $259.20; Clearfield, Pa., $259.40; St. Louis, $259.45; Bridgeburg, Pa., $286.

Runners (per 1000)
Reesdale, Johnstown, Bridgeburg, Pa., $196; Clearfield, Pa., $198; St. Louis, $195.80.

Dolomite (per net ton)
Domestic, dead-burned, bulk, Billmeyer, Blue Bell, Williams, Plymouth Meeting, York, Pa., Millville, W. Va., Bettsville, Millersville, Martin, Woodville, O., Gibsonburg, Narlo, O., $15; Thornton, McCook, Ill., $15.60; Dolly Siding, Bonne Terre, Mo., $14.

Magnesite (per net ton)
Domestic, dead-burned, bulk, ⅛-in. grains with fines: Chewelah, Wash., $40; Luning, Nev., $40. ⅝-in. grains with fines: Baltimore, $66.40.

Metallurgical Coke

Price per net ton

Beehive Ovens

Connellsville, furnace	$13.25-$14.00
Connellsville, foundry	16.00-17.00

Oven Foundry Coke

Kearny, N. J., ovens	$25.50
Camden, N. J., ovens	25.00
Everett, Mass., ovens	
New England, deld.	*27.05
Chicago, ovens	25.75
Chicago, deld.	27.25
Terre Haute, Ind., ovens	25.50
Milwaukee, ovens	26.25
Indianapolis, ovens	25.50
Portsmouth, O., ovens	24.75
Cincinnati, deld.	27.34
Painesville, O., ovens	26.25
Cleveland, deld.	28.18
Erie, Pa., ovens	25.00
Birmingham, ovens	22.65
Cincinnati, deld.	27.58
Buffalo, ovens	25.75
Buffalo, deld.	27.00
Lone Star, Tex., ovens	19.50
Neville Island, Pa., ovens	25.00
Philadelphia, ovens	25.00
Swedeland, Pa., ovens	25.00
St. Louis, ovens	
St. Louis, deld.	26.00
St. Paul, ovens	25.00
Detroit, ovens	26.25
Detroit, deld.	27.25
Pontiac, deld.	27.81
Saginaw, deld.	29.33

*Or within $4.55 freight zone from works.

Coal Chemicals

Spot, cents per gallon, ovens

Pure benzol	36.00
Toluol, one deg.	32.00-35.00
Industrial xylol	32.00-35.00

Per ton, bulk, ovens

Ammonium sulphate	$42-$45
Birmingham area	42.00†

†With port equalization against imports.
Cents per pound, producing point
Phenol: Grade 1, 14.00; Grade 2-3, 13.50; Grade 4, 15.50; Grade 5, 14.25.

Fluorspar

Metallurgical grades, f.o.b. shipping point, in Ill., Ky., net tons, carloads, effective CaF_2 content 72.5%, $38-$39; 70%, $35-$36; 60%, $31-$32. Imported, net tons, f.o.b. cars point of entry, duty paid, metallurgical grade: European, $34; Mexican, $25.50.

Electrodes

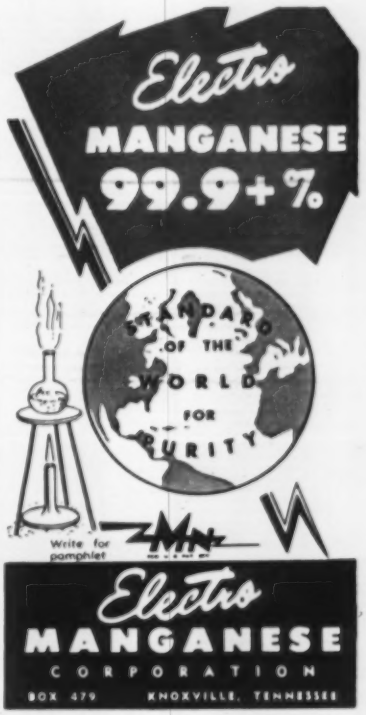
Threaded with nipple, unboxed, f.o.b. plant

GRAPHITE

Inches Diam	Length	Per 100 lb
2	24	$52.50
2½	30	33.75
3	40	32.00
4	40	30.25
5¼	40	30.00
6	60	27.25
7	60	26.75
8, 9, 10	60	24.25
12	72	27.25
14	60	23.50
16	72	22.50
17	60	23.00
18	72	22.50
20	72	22.25

CARBON

8	60	12.10
10	60	11.80
12	60	11.75
14	60	11.70
14	72	10.85
17	60	10.75
17	72	10.35
20	84	10.30
20	90	10.10
24	72, 84	10.30
24	96	10.05
30	84	10.20
40, 35	110	9.90
40	100	9.90



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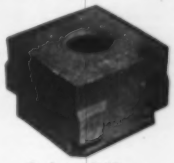
Dunbar, Pa. 4213
COVERED HOT TOP BRICK
INGOT MOLD PLUGS



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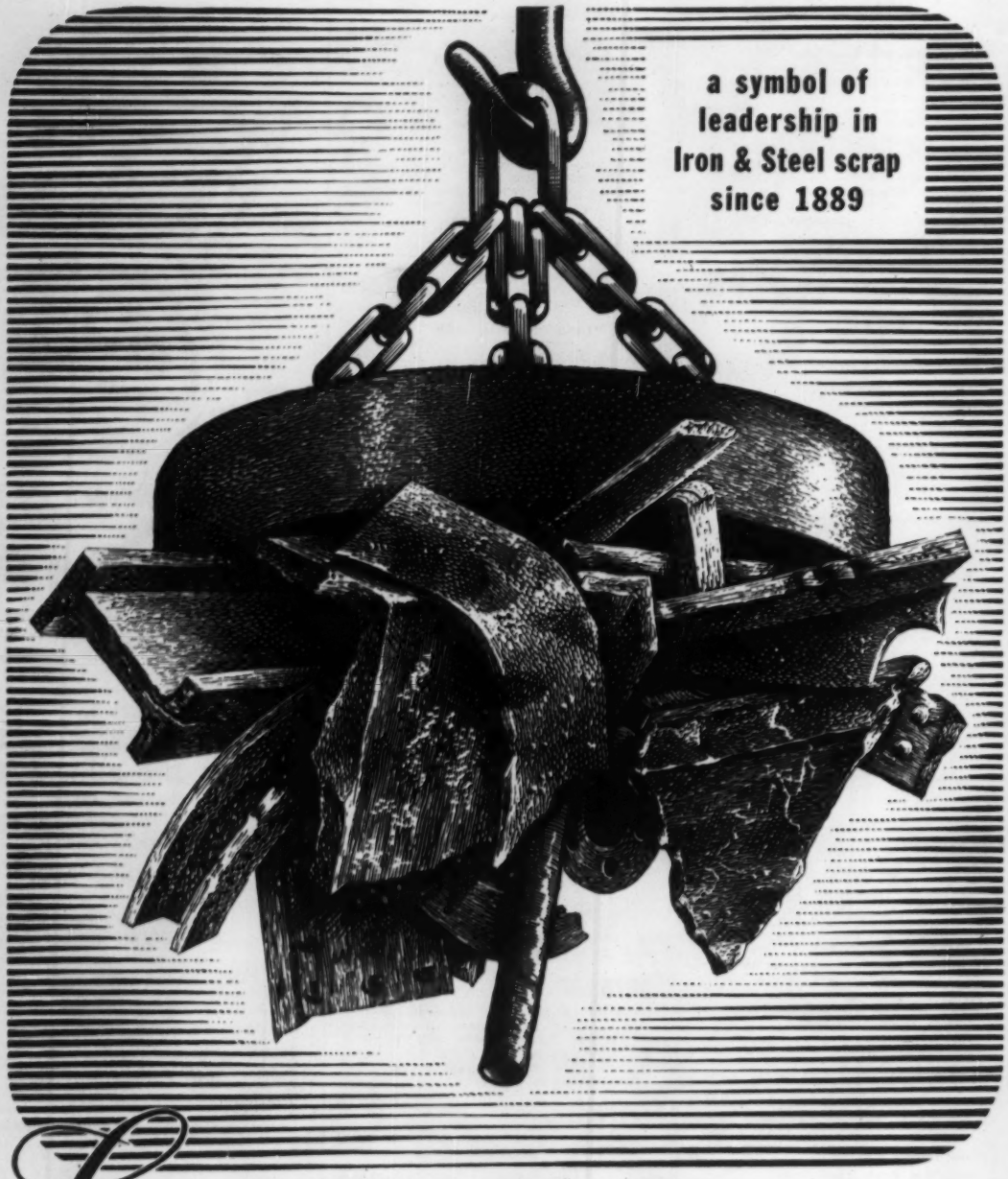
PITTSBURGH 30 NEW YORK 7
CHICAGO 4 HOUSTON 2 LOS ANGELES 5



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EXPORTS-IMPORTS—LIVINGSTON & SOUTHARD, INC. 99 Park Ave., New York, N. Y. *Cable Address:* FORENTRACO

Scrap . . .

Scrap Prices, Page 284

Pittsburgh — Two mill purchases early this month put life in a dull market. A mill on the fringe of the district made a "normal-sized" purchase of No. 1 heavy melting scrap at $45 and No. 2 heavy melting at $40 to $41 a ton. A mill nearer Pittsburgh bought No. 2 heavy melting scrap at $41 and No. 2 bundles at $38 a ton. There's some disagreement as to the strength of No. 2 bundles, with prices $2 a ton lower being rumored.

Despite this increase in the scrap movement, sales of scrap are considered low in view of predicted high fourth quarter steelmaking operations and heavy scrap movement in some other districts. Brokers continue to report a "strong undertone" in the market.

Boston — Steel scrap prices are slightly higher, including borings and turnings, based on buying by district and eastern Pennsylvania consumers. Shipments are more active from yards, with supplies ample to meet current demands. Cast scrap is moving slowly at unchanged prices.

New York — With broker buying slightly more active against orders for consumers, steel scrap prices are unchanged. Yard suppliers are moving greater volume; stocks balance demand. No. 1 cupola cast is up $1.50, with brokers paying $36.

Philadelphia—Scrap prices are generally unchanged. The only revision noted is an advance on No. 1 cupola to $40-$42, delivered. This reflects continued drain on supplies by consumers outside the district, particularly Virginia. The two leading pipe mills in this area are paying $42, delivered, with one paying as high as $43 for cupola cast from New England. The Florence, N. J., pipe shop, which is curtailing operations this month while making plant improvements, will continue to take in scrap as usual.

Buffalo—Substantial purchases of steelmaking scrap at established prices by a leading district mill consumer has served to sustain strength in the market. Cast grades also are strong.

Cincinnati—Prices on scrap rails moved up $1 to $2 a ton on strong demand from rerollers. One-foot plate and breakable cast also advanced. The other grades are holding steady in the absence of local buying. Brokers are of the opinion that the market may do a lot of jumping once orders are placed, making it difficult for them to cover contracts.

Detroit—Scrap prices are relatively on a par with those prevailing here a month ago. The mills are paying the same, and auto lists are about the same.

Chicago—A small purchase of No. 2 bundles at $34 a gross ton, up $2 over the price which had prevailed for several weeks, was reported last week. This sale serves as a mild shot-in-the-arm for material of dealer origin. Until now, advances in industrial grades of up to $4 a ton had failed to sharpen interest of consumers in dealer offerings. How to interpret the latest purchase is a question. The smallness of the order could indicate that the buyer seeks minimum stimulation of the market, or that sellers are unwilling to commit themselves for bigger volume at the new price.

Cleveland — The price on No. 1 heavy melting steel is up about $1 a ton in this market as a result of substantial sales in the Valley the last week or so. Two large mills in that district bought tonnage, paying up to $48.50. In general, the market displays strength, with steelmaking operations holding at boom pace. Low phos material is quoted up here as result of a purchase by one large foundry.

St. Louis—Mills are about ready to re-enter the scrap market. Their stockpiles have dwindled owing to small receipts and continued high operations. They have raised their bid prices on No. 1 and No. 2 heavy melting steel and bundles to equalize with Chicago and Kansas City offerings.

Birmingham — Steel scrap prices are unchanged here, but an Atlanta, Ga. mill increased its price for No. 2 heavy melting steel $1, offering $36 for shipments on nearby tonnage with a premium of $5 for scrap originating in areas where freight to Atlanta is $4.01 and up.

Los Angeles—The scrap market is firm here. No. 2 bundles have been advanced $2 a ton to $27. No. 1 cupola cast has steadied at $42 after fluctuating for several months.

San Francisco—Scrap prices are unchanged here at $34 for No. 1 steel, but traders anticipate an early rise. Exporters are paying up to $37 for top grades.

Seattle—The scrap market is firm. No. 1 is quoted at $39.50; No. 2 heavy melting at $35.50. These prices are the highest in recent years and reflect increased local consumption and an active export movement.

(*Please turn to page* 286)

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Sterling WHEELBARROWS

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Iron and Steel Scrap

Consumer prices, per gross ton, except as otherwise noted, including broker's commission, as reported to STEEL. *Changes shown in italics.*

STEELMAKING SCRAP COMPOSITE

Oct. 5	$45.33
Sept. 28	45.00
Sept. Avg.	44.42
Oct. 1954	32.25
Oct. 1950	41.37

Based on No. 1 heavy melting grade at Pittsburgh, Chicago and eastern Pennsylvania.

PITTSBURGH

(Delivered consumer's plant)

No. 1 heavy melting	*44.00-45.00*
No. 2 heavy melting	*40.00-41.00*
No. 1 bundles	*44.00-45.00*
No. 2 bundles	*37.00-38.00*
No. 1 busheling	*44.00-45.00*
Machine shop turnings	29.00-30.00
Mixed borings, turnings	29.00-30.00
Short shovel turnings	32.00-33.00
Cast iron borings	32.00-33.00
Cut structurals, 3 ft lengths	49.00-50.00
Heavy turnings	42.00-43.00
Punchings & plate scrap	49.00-50.00
Electric furnace bundles	48.00-49.00

Cast Iron Grades

No. 1 cupola	42.00-43.00
Charging box cast	38.00-39.00
Heavy breakable cast	38.00-39.00
Unstripped motor blocks	29.00-30.00
No. 1 machinery cast	46.00-47.00

Railroad Scrap

No. 1 R.R. heavy melt.	47.00-48.00
Rails, 2 ft and under	54.00-55.00
Rails, 18 in. and under	55.00-56.00
Rails, random lengths	51.00-52.00
Railroad specialties	53.00-54.00

Stainless Steel Scrap

18-8 bundles & solids	270.00-285.00
18-8 turnings	130.00-140.00
430 bundles & solids	100.00-110.00
430 turnings	60.00-65.00

CLEVELAND

(Delivered consumer's plant)

No. 1 heavy melting	*44.00-45.00*
No. 2 heavy melting	32.00-33.00
No. 1 bundles	*44.00-45.00*
No. 2 bundles	29.00-30.00
No. 1 busheling	*44.00-45.00*
Machine shop turnings	23.00-24.00
Mixed borings, turnings	27.50-28.50
Short shovel turnings	27.50-28.50
Cast iron borings	27.50-28.50
Low phos.	45.00-46.00
Cut structural plates 2 ft and under	*49.00-50.00*
Alloy free, short shovel turnings	31.00-32.00
Electric furnace bundles	*44.00-45.00*

Cast Iron Grades

No. 1 cupola	47.00-48.00
Charging box cast	40.00-41.00
Stove plate	46.00-47.00
Heavy breakable cast	37.00-38.00
Unstripped motor blocks	29.00-30.00
Brake shoes	35.00-36.00
Clean auto cast	48.00-49.00
Burnt cast	37.00-38.00
Drop broken machinery	49.00-50.00

Railroad Scrap

No. 1 R.R. heavy melt.	45.00-46.00
R.R. malleable	51.00-52.00
Rails, 2 ft and under	*57.00-58.00*
Rails, 18 in. and under	*58.00-59.00*
Rails, random lengths	50.00-51.00
Cast steel	46.00-47.00
Railroad specialties	52.00-53.00
Uncut tires	47.00-48.00
Angles, splice bars	53.50-54.50
Rails, rerolling	60.00-61.00

Stainless Steel

(Brokers' buying prices; f.o.b. shipping point)

18-8 bundles, solids	*290.00-300.00*
18-8 turnings	130.00-140.00
430 clips, bundles, solids	90.00-100.00
430 turnings	40.00-50.00

YOUNGSTOWN

(Delivered consumer's plant)

No. 1 heavy melting	*47.50-48.50*
No. 2 heavy melting	36.00-36.00
No. 1 bundles	*47.50-48.50*
No. 2 bundles	32.00-33.00
No. 1 busheling	*47.50-48.50*
Machine shop turnings	24.00-25.00
Short shovel turnings	29.00-30.00
Cast iron borings	29.00-30.00
Low phos.	*47.50-48.50*
Electric furnace bundles	*47.50-48.50*

Railroad Scrap

No. 1 R.R. heavy melt.	*48.00-49.00*

CHICAGO

No. 1 heavy melting	44.00-46.00
No. 2 heavy melting	36.00-37.00
No. 1 factory bundles	46.00-47.00
No. 1 dealer bundles	43.00-44.00
No. 2 bundles	*33.00-34.00*
No. 1 busheling	44.00-46.00
Machine shop turnings	29.00-30.00
Mixed borings, turnings	29.00-30.00
Short shovel turnings	31.00-32.00
Cast iron borings	31.00-32.00
Cut structurals, 3 ft	47.00-48.00
Punchings & plate scrap	48.00-49.00

Cast Iron Grades

No. 1 cupola	48.00-49.00
Stove plate	37.00-38.00
Unstripped motor blocks	34.00-35.00
Clean auto cast	*53.00-54.00*
Drop broken machinery	*53.00-54.00*

Railroad Scrap

No. 1 R.R. heavy melt.	47.00-48.00
R.R. malleable	54.00-55.00
Rails, 2 ft and under	59.00-60.00
Rails, 18 in. and under	60.00-61.00
Angles, splice bars	56.00-57.00
Rails, rerolling	65.00-66.00

Stainless Steel Scrap

18-8 bundles & solids	290.00-300.00
18-8 turnings	160.00-170.00
430 bundles & solids	100.00-105.00
430 turnings	45.00-50.00

DETROIT

(Brokers' buying prices; f.o.b. shipping point)

No. 1 heavy melting	40.00
No. 2 heavy melting	30.00
No. 1 bundles	40.00
No. 2 bundles	29.00
No. 1 busheling	40.00
Machine shop turnings	22.50
Mixed borings, turnings	22.50
Short shovel turnings	25.50
Punchings & plate scrap	*46.50*

Cast Iron Grades

Charging box cast	32.00
No. 1 cupola	39.00
Stove plate	32.00
Heavy breakable	32.00
Unstripped motor blocks	22.00
Clean auto cast	*44.00*
Malleable	35.00

BIRMINGHAM

No. 1 heavy melting	36.00-37.00
No. 2 heavy melting	32.00-33.00
No. 1 bundles	36.00-37.00
No. 2 bundles	28.00-29.00
No. 1 busheling	36.00-37.00
Cast iron borings	17.00-18.00
Short shovel turnings	26.00-27.00
Machine shop turnings	*25.00-26.00*
Electric furnace bundles	*38.00-39.00*

Cast Iron Grades (F.o.b. shipping point)

No. 1 cupola	47.50-48.00
Stove plate	44.50-45.50
Rails, rerolling	*56.00-57.00*
Rails, random lengths	*51.00-52.00*
Unstripped motor blocks	36.00-37.00
Charging box cast	28.00-29.00
No. 1 wheels	38.00-39.00

Railroad Scrap

Bar crops and plate	*43.00-44.00*
Structural plate, 2 ft	*42.00-43.00*
Rails, 18-in. and under	*57.00-58.00*
No. 1 R.R. heavy melt.	42.00-43.00
Angles, splice bars	50.00-51.00

PHILADELPHIA

(Delivered consumer's plant)

No. 1 heavy melting	46.00-47.00
No. 2 heavy melting	40.00-41.00
No. 1 bundles	46.00-47.00
No. 2 bundles	37.00-39.00
No. 1 busheling	46.00-47.00
Electric furnace bundles	47.50
Machine shop turnings	28.00-28.50
Mixed borings, turnings	27.00-28.00
Short shovel turnings	30.50-31.00
Structurals & plate	49.00-50.00
Heavy turnings	42.00
Couplers, springs, wheels	51.00
Rail crops, 2 ft & under	58.00

Cast Iron Grades

No. 1 cupola	*40.00-42.00*
Malleable	58.00
Heavy breakable cast	45.00-46.00
Drop broken machinery	47.00-48.00

NEW YORK

(Brokers' buying prices)

No. 1 heavy melting	41.00-42.00
No. 2 heavy melting	37.00-38.00
No. 1 bundles	40.50-41.50
No. 2 bundles	32.00-33.00
Machine shop turnings	20.00-21.00
Mixed borings, turnings	21.00-22.00
Short shovel turnings	22.00-23.00
Low phos. (structural & plate)	42.00-43.00

Cast Iron Grades

No. 1 cupola	*36.00*
Unstripped motor blocks	25.00-26.00
Heavy breakable	38.00-39.00

Stainless Steel

18-8 borings, turnings	150.00-160.00
430 sheets, clips, solids	115.00-120.00
410 sheets, clips, solids	100.00-105.00
18-8 sheets, clips, solids	280.00-285.00

BOSTON

(Brokers' buying prices; f.o.b. shipping point)

No. 1 heavy melting	*36.50-37.50*
No. 2 heavy melting	*31.00-31.50*
No. 1 bundles	*36.50-37.50*
No. 2 bundles	*27.00-27.50*
Machine shop turnings	18.50-19.00
Mixed borings, turnings	*22.50-23.00*
Short shovel turnings	*23.50-24.00*
No. 1 cast	30.00-31.00
Mixed cupola cast	28.00-29.00
No. 1 machinery cast	35.00-36.00

BUFFALO

No. 1 heavy melting	38.00-39.00
No. 2 heavy melting	35.00-36.00
No. 1 bundles	38.00-39.00
No. 2 bundles	32.00-33.00
No. 1 busheling	38.00-39.00
Mixed borings, turnings	28.00-29.00
Machine shop turnings	26.00-27.00
Short shovel turnings	29.00-30.00
Cast iron borings	29.00-30.00
Low phos.	45.00-46.00

Cast Iron Grades (F.o.b. shipping point)

No. 1 cupola	40.00-41.00
No. 1 machinery	43.00-44.00

Railroad Scrap

Rails, random lengths	47.00-48.00
Rails, 2 ft and under	51.00-52.00
Railroad specialties	48.00-49.00

CINCINNATI

(Brokers' buying prices; f.o.b. shipping point)

No. 1 heavy melting	40.00-41.00
No. 2 heavy melting	34.00-35.00
No. 1 bundles	40.00-41.00
No. 2 bundles	31.00-32.00
No. 1 busheling	40.00-41.00
Machine shop turnings	26.00-27.00
Mixed borings, turnings	23.00-24.00
Short shovel turnings	29.00-30.00
Cast iron borings	23.00-24.50
Low phos., 18 in.	*48.00-49.00*

Cast Iron Grades

No. 1 cupola	45.00-46.00
Heavy breakable cast	*40.00-41.00*
Charging box cast	38.00-39.00
Drop broken machinery	49.00-50.00

Railroad Scrap

No. 1 R.R. heavy melt	*44.00-45.00*
Rails, 18 in. and under	57.00-58.00
Rails, random lengths	*51.00-52.00*

ST. LOUIS

(Brokers' buying prices)

No. 1 heavy melting	36.50
No. 2 heavy melting	34.00
No. 1 bundles	36.50
No. 2 bundles	29.50
Machine shop turnings	27.00
Short shovel turnings	27.00

Cast Iron Grades

No. 1 cupola	46.50
Charging box cast	39.00
Heavy breakable cast	36.00
Unstripped motor blocks	*37.00*
Brake shoes	36.00
Clean auto cast	46.00
Stove plate	37.00

Railroad Scrap

No. 1 R.R. heavy melt	46.50
Rails, 18 in. and under	55.00
Rails, random lengths	*55.00*
Rails, rerolling	64.00
Angles, splice bars	51.50

SEATTLE

(Delivered consumer's plant)

No. 1 heavy melting	39.50
No. 2 heavy melting	35.50
No. 1 bundles	35.50
No. 2 bundles	30.50
No. 3 bundles	19.00
Machine shop turnings	15.00-16.00
Mixed borings, turnings	15.00-16.00
Short shovel turnings	15.00-16.00
Electric furnace, No. 1	42.00-44.00

Cast Iron Grades (F.o.b. shipping point)

No. 1 cupola	*36.00-38.00*
Heavy breakable cast	*32.00-34.00*
No. 1 wheels	35.00
Unstripped motor blocks	29.00
Clean motor blocks	*40.00*
Stove plate (f.o.b. plant)	*28.00-30.00*
Brake shoes	*30.00-32.00*

Railroad Scrap (Delivered consumer's plant)

Rails, random lengths	33.00

LOS ANGELES

No. 1 heavy melting	32.00
No. 2 heavy melting	30.00
No. 1 bundles	32.00
No. 2 bundles	27.00
Machine shop turnings	10.00

Cast Iron Grades (F.o.b. shipping point)

No. 1 cupola	43.00-45.00

SAN FRANCISCO

No. 1 heavy melting	34.00
No. 2 heavy melting	32.00
No. 1 bundles	34.00
No. 2 bundles	29.00
No. 1 busheling	34.00
Machine shop turnings	14.00
Mixed borings, turnings	14.00
Short shovel turnings	16.00
Cast iron borings	16.00
Cut structurals	36.00
Heavy turnings	14.00
Punchings & plate scrap	34.00

Cast Iron Grades

No. 1 cupola	42.00
Charging box cast	35.00
Stove plate	37.00
Heavy breakable cast	36.00
Unstripped motor blocks	30.00
Brake shoes	35.00
Clean auto cast	39.00
No. 1 wheels	39.00
Burnt cast	23.00
Drop broken machinery	48.00

HAMILTON, ONT.

(Delivered prices)

No. 1 heavy melting	38.50
No. 2 heavy melting	35.50
No. 1 bundles	38.50
No. 2 bundles	32.50
Mixed steel scrap	32.50
Mixed borings, turnings	17.00
Rails, remelting	47.50
Busheling, new factory: Prepared	36.50
Unprepared	32.50
Short steel turnings	21.00

Cast Iron Grades†

No. 1 machinery cast	42.00-45.00

†F.o.b., shipping point.

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In the large stamping plants and rolling mills where it is critically important that trim and stamping skeletons are quickly disposed of to avoid interference with production, LOGEMANN metal balers are relied on to keep ahead of production and pack such scrap into high density, self-cohering bricks for re-melting.

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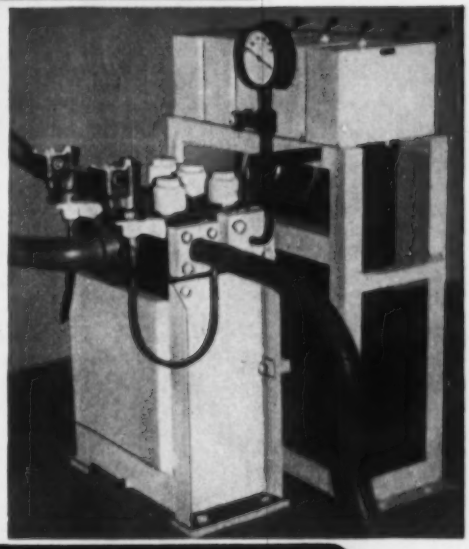
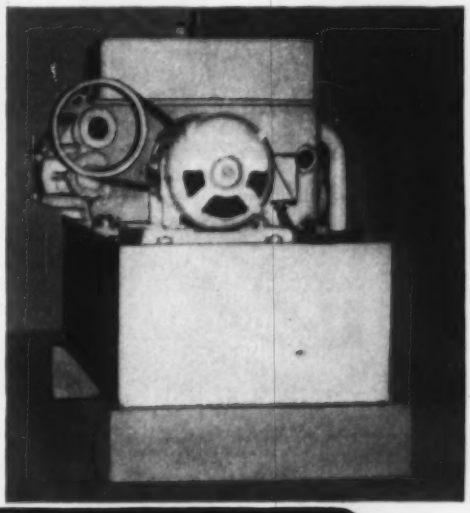
LOGEMANN models are not confined to the large sizes. Many small plants have found it profitable to use smaller sizes embodying the same features of reliability, at minimum operating cost. Interested parties are invited to write for details. Information as to the character of the scrap, tonnage to be handled in a given period of hours, and range of gauges is helpful in determining the proper model.



HYDRAULIC VALVES

The illustration shows a close-coupled hydraulic valve, operated by compressed-air cylinders for high-speed distribution of large gallonage of fluid at high pressure. LOGEMANN engineers have designed and built valves for many unusual as well as standard applications, and will welcome inquiries, with an outline of the conditions and requirements.



HYDRAULIC PUMPS

The opposed-cylinder close-coupled double pressure pump shown in the illustration is mounted on an individual tank to conserve floor space under present crowded plant and operating conditions. When requesting details, please indicate the nature of the service, pressure and gallonage requirements, and the fluid to be handled.

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(*Concluded from page 283*)

Shipments from interior points are increasing.

Pig Iron . . .

Pig Iron Prices, Page 271

Mystic Iron Works, Everett, Mass., has advanced prices for the fourth quarter $1.50 a ton to $62.50, f.o.b. furnace, for No. 2 foundry grade pig iron. Usual differentials are maintained for basic and malleable. Mystic did not advance prices in July as did other producers.

October continues to shape up as an active castings production month—probably the best since last May. This is supporting solid demand for pig iron from gray iron and malleable shops.

Shipments of pig iron are heavier to jobbing shops which also have comfortable order backlogs.

U. S. Steel Corp. lighted No. 7 blast furnace Oct. 1 at Homestead District Works' Carrie Furnaces, Rankin, Pa.

Iron Ore . . .

Iron Ore Prices, Page 281

Shipments of Lake Superior iron ore in the week ended Oct. 3 totaled 2,772,845 gross tons, reports the Lake Superior Iron Ore Association. Cumulative shipments in the 1955 navigation season now stand at 68,564,282 gross tons, up sharply from the 51,325,492 tons moved in the like period of 1954. In record 1953, the cumulative movement to the first week of October was about 79 million tons.

The U. S. Army Corps of Engineers will issue early next month plans and specifications for construction of a multimillion-dollar canal lock near Massena, N. Y. This project, to be known as the Robinson Bay lock, will be the first sizable contract on the U. S. side of the St. Lawrence Seaway not primarily for excavation or dike work. The lock will be 860 ft long, 80 ft wide and will have a maximum lift of 49 ft. The lock walls will vary from 105 to 115 ft high. About 1130 tons of reinforcing steel will be required. The government has set May 15, 1958, as the deadline for completion.

Tubular Goods . . .

Tubular Goods Prices, Page 270

Oil country goods are generally sold out through the remainder of this year. At the same time heavy demand is in prospect for early 1956.

One Pittsburgh producer says it could sell its entire first quarter output now if it were disposed to open

Your machining department for hardened and precision ground screw machine products. Send for brochure & equipment list.

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OTTAWA STEEL PRODUCTS INC.
Grand Haven Michigan

they all know the best place in Cleveland

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Hotel Cleveland
SONNABEND OPERATED HOTELS
Distinguished American Landmarks
CHICAGO: Edgewater Beach Hotel
BOSTON: Hotel Somerset
NEW YORK CITY: Ritz Tower Hotel
CLEVELAND: Hotel Cleveland

books for that period. While some pipemakers plan to open first quarter books in a few weeks to take advantage of the heavy demand, others, more cautious, will delay acceptances for the next delivery period until November.

The main problem for producers is the filling of steadily increasing demand for high-alloy oil country tubing, used in the deepest wells.

Welded pipe sales continue to increase. A major producer has the largest backlog of unfilled orders in its history. Commitments are being made for December delivery.

Cast iron pipe sellers in the Pacific Northwest report a lull in demand, due in part to delayed deliveries resulting from heavy placements early this year.

Warehouse . . .

Warehouse Prices, Page 271

Distributors are experiencing stronger demand for products on which mills find themselves farthest behind on deliveries. They include cold-rolled sheets, wide, hot-rolled sheets, plates and wide flanged structurals.

Unfortunately, distributors experience shipment arrearages the same as other mill customers and are unable to accept more than a limited volume of proffered business.

In the New England district, bookings are averaging close to 25 per cent ahead of those a year ago. To meet this heavier demand, stocks were better rounded out than was the case two years back when the warehouses were shipping large tonnages.

A mild gray market is developing in the East in structurals, although premium-priced volume is small.

Fasteners . . .

Bolt, Nut, Rivet Prices, Page 269

Railroad purchasing is definitely on the upswing, says the sales manager of a major producer of industrial fasteners in the Pittsburgh district. The large railroad car building program is being reflected in commitments extending into next year. Requirements for flood repair work in the East are heavy. Large quantity orders are coming from other areas, while automakers' needs continue high.

Rails, Cars . . .

Track Material Prices, Page 269

Increased activity at the coal mines and growing maintenance needs at steel plants are bolstering demand for light rails. Sales for inplant movment of products have been slow.

LARGE MACHINE AND WELDMENT CAPACITY

Open capacity on 24 ft. and 10 ft. Vertical Boring Mills 7", 5" and 4" Horizontal Boring Mills; large radials and supporting small machines including new 2 AC Warner & Swasey automatic chucking. Especially interested in producing weldments requiring machining.

C. H. WHEELER MANUFACTURING CO.
Sedgley Ave. at 19th & Lehigh
Philadelphia 32, Pa.
Phone: Henry Kingston—Sagamore 2-6500

MANUFACTURER'S SALES REPRESENTATIVES

Aggressive forging representatives for Chicago and Detroit Areas to sell steel drop and upset forgings for a well-rated and long-established Central New York manufacturing corporation, on straight commission basis. Metallurgical and Mechanical Engineering experience desirable.

Write—stating resume of personal data, past experience and employment, qualifications, etc., to

Box 317, STEEL
Penton Building Cleveland 13, Ohio

CLASSIFIED

Help Wanted

ELECTRICAL ENGINEER EXPERIENCED IN INDUCTION HEATING. Must be capable of designing induction heating and control components. Established concern. Salary open. Reply Box 312, STEEL, Penton Bldg., Cleveland 13, Ohio.

WANTED: PRODUCTION SCHEDULER. Man with steel mill experience to head up scheduling department of a small steel plant engaged in making, rolling, and fabricating steel products. State age, education, experience, and salary expected. Please reply to Box 315, STEEL, Penton Bldg., Cleveland 13, Ohio.

WANTED . . . METALLURGIST
For applied research and development work in the non-ferrous field . . . aluminum and copper alloys. Involves castings and/or rolling of mono and bimetals. Requires an aggressive individual capable of handling a variety of projects. This is a pleasant, permanent position with a large, nationally known manufacturer located in a medium-size, midwest city. Congenial working conditions, liberal vacations, insurance, welfare and pension benefits. Excellent starting salary with every opportunity for advancement. Reply in complete confidence stating education, experience, references, etc. Reply Box 316, STEEL, Penton Bldg., Cleveland 13, Ohio.

Positions Wanted

GENERAL SUPERINTENDENT
Steel Fabrication. 30 years practical experience, light, medium, heavy fabrication and electric welded tubing processes and fabrication. Prefer plant of 100 to 1,000 employees. Reply Box 318, STEEL, Penton Bldg., Cleveland 13, Ohio.

STRUCTURAL ENGINEER AND MANUFACTURERS SALES REPRESENTATIVE 14 YEARS EXPERIENCE, 4 YEARS IN OWN BUSINESS. NEED GOOD POSITION WITH REAL FUTURE OR WILL CONTRACT TO FURNISH COMPLETE STRUCTURAL SHOP DETAILS TO FABRICATORS AT A REASONABLE AGREED RATE. REPLY TO WAGNER EQUIPMENT & ENGINEERING SERVICE, BOX 7997, KANSAS CITY 29, MISSOURI.

FOR CLASSIFIED RATES

And Further information write
STEEL, Penton Bldg., Cleveland 13, O.

STRUCTURAL STEEL

SHOP SUPERINTENDENT

A large corporation requires the service of a well-qualified man who is thoroughly experienced in the fabrication methods of plate and structural steel.

Write giving experience and salary requirements.

Reply Box 314, STEEL
Penton Building Cleveland 13, Ohio

ENGINEERS

The expansion of our plant engineering department has created excellent opportunities for engineers in the design, maintenance and construction of rolling mills

Year round outdoor living in suburban communities adjacent to plant. Seashore and mountain resort areas nearby.

Send complete resume, including salary requirements, to Employment Manager

KAISER STEEL CORP.
P.O. BOX 217
FONTANA, CALIFORNIA

HIGH TEMPERATURE HEAT EXCHANGE PROJECT ENGINEER

Leading manufacturer of air conditioning, heating, ventilating and heat treansfer equipment is seeking an engineer to direct a development program on brazed stainless steel heat exchangers. Preliminary phases of the program are now in progress.

The candidate should have a record of success in concluding experimental programs. He should have experience with brazing and welding, particularly with high temperature materials. Knowledge of furnaces (or other heat treating equipment) would be helpful. Engineering degree desirable but not required. Metallurgists satisfying similar requirements considered.

Write giving detailed resume of experience and salary desired to:

MANAGER OF STAFF EMPLOYMENT
THE TRANE COMPANY
LA CROSSE WISCONSIN

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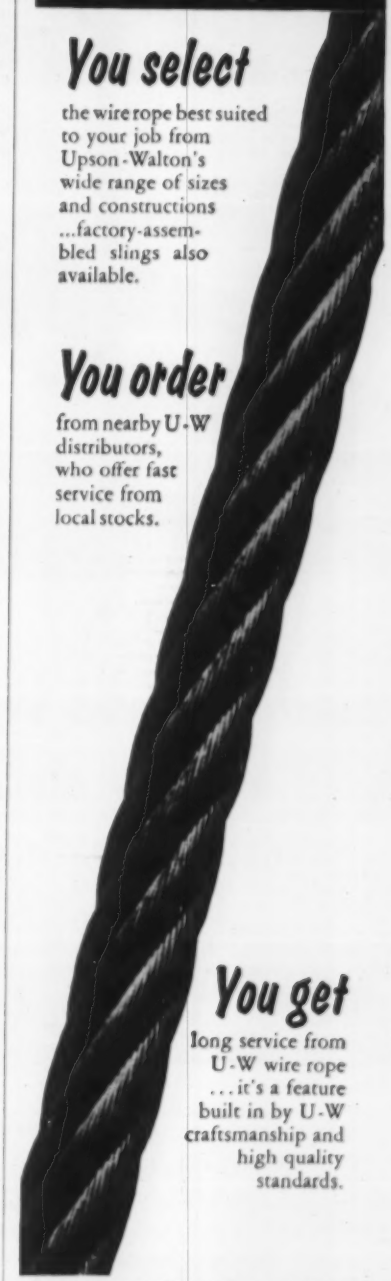
wire rope



You select
the wire rope best suited to your job from Upson-Walton's wide range of sizes and constructions ...factory-assembled slings also available.

You order
from nearby U-W distributors, who offer fast service from local stocks.

You get
long service from U-W wire rope ...it's a feature built in by U-W craftsmanship and high quality standards.

THE UPSON-WALTON COMPANY
12500 ELMWOOD AVE. • CLEVELAND 11, OHIO
New York • Chicago • Pittsburgh
MANUFACTURERS OF
WIRE ROPE, ROPE FITTINGS, TACKLE BLOCKS
ESTABLISHED 1871

(Advertisement)

A Model MOD (Duplex) Oil-Actuated Multiple Plate Clutch.

B Model MTU (Duplex) Mechanically-Actuated Multiple Plate Clutch (Dry Operating).

C Model MTS (Single) Mechanically-Actuated Multiple Plate Clutch (Oil Operating).

Multiple Plate Twin Disc Clutches provide simple design, quick adjustment, long life

Twin Disc Model MOS (single) and MOD (duplex) Oil-Actuated Multiple Plate Clutches—offer machine tool designers *plus* advantages never before available. They are Twin Disc's answer to the demand for high energy, high inertia, high horsepower clutches especially adaptable to applications creating high temperatures and operating under heavy, abusive loads.

Models MOS and MOD clutches give *new* performance on the job *because:*

- New, integral oil cylinder clamps plate stack, compensates automatically for friction plate wear.
- Mechanical controls to take up or adjust for wear are eliminated. Wear life is longer!
- A *floating* pressure plate is the ram of the cylinder. As plate stacks wear, ram travel increases automatically.
- Torque capacity of clutch is always constant for a given oil pressure. There's no loss of torque through plate wear or varying adjustment.
- Constant torque capacity often permits more compact installation of a *smaller* clutch . . . saves space and cost.
- They're adaptable to remote control without complicated actuating linkage.
- They offer *continuous* service with minimum maintenance.

Twin Disc Model MTS (single) and MTU (duplex) Mechanically-Actuated Multiple Plate Clutches—are the standard of the industry for machine tool users who prefer mechanical actuation. These long-established, proven-performance clutches *feature:*

- High clamping efficiency — with comparatively low pressure on clutch lever.
- High torque capacity—with longer wear life. Single-point adjustment to reduce maintenance time.
- Compact design — to operate in minimum of space. (Shorter clutch lengths).
- Stability—unaffected by centrifugal action. Permit high rotation speeds.
- Close tolerances—all parts accurately machined.
- Heat-treating of operating parts—for maximum strength and longest operating life.

Twin Disc Mechanically-Actuated Multiple Plate Clutches, Models MTS and MTU, are available for either dry or oil operation, in capacities from .47 to 44 hp per 100 rpm. Write today for Bulletin 134-B, and complete information to help you select the *proper* type and size Twin Disc Multiple Plate Clutch for your application. Twin Disc Clutch Company, Racine, Wisconsin, Hydraulic Division, Rockford, Illinois.

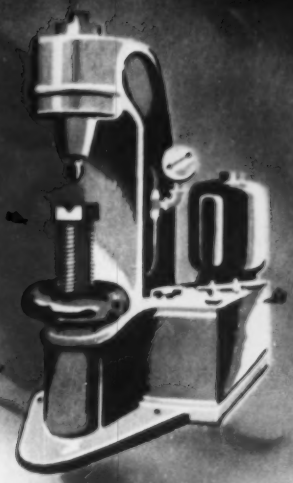
TWIN DISC

TWIN DISC

Friction Clutches and Fluid Drives

Uniformity!

THE CONTROL OF
EVERY SQUARE INCH
OF EVERY COIL



UNIFORMITY — that's the big reason why so many of the leading steel producers are specifying Annealing Furnaces by Lee Wilson. The exclusive method by which Wilson furnaces apply the heat to the charge enables users to get exacting control of every inch of every coil. It's precision annealing in its most advanced stage. Look them over — talk with users and you'll be convinced there's nothing that approaches the speed and uniformity of the Lee Wilson furnace. And why not? It's a product of the originator and leading producer of radiant tube, single-stack annealing systems.
FOR YOUR FILES: *Brochures and data sheets that give you the complete story.*

Lee Wilson **ENGINEERING COMPANY, INC.**
20005 West Lake Road, Cleveland 16, Ohio

Takes the shock around the clock with TIMKEN® bearings on the axles

WHEN tons of steel pour into the molds on these ingot cars, terrific shock loads hit the bearings. Bouncing over rough track also puts shock loads on the bearings. That's why the axles of all the ingot cars in this large Eastern steel mill roll on Timken® tapered roller bearings.

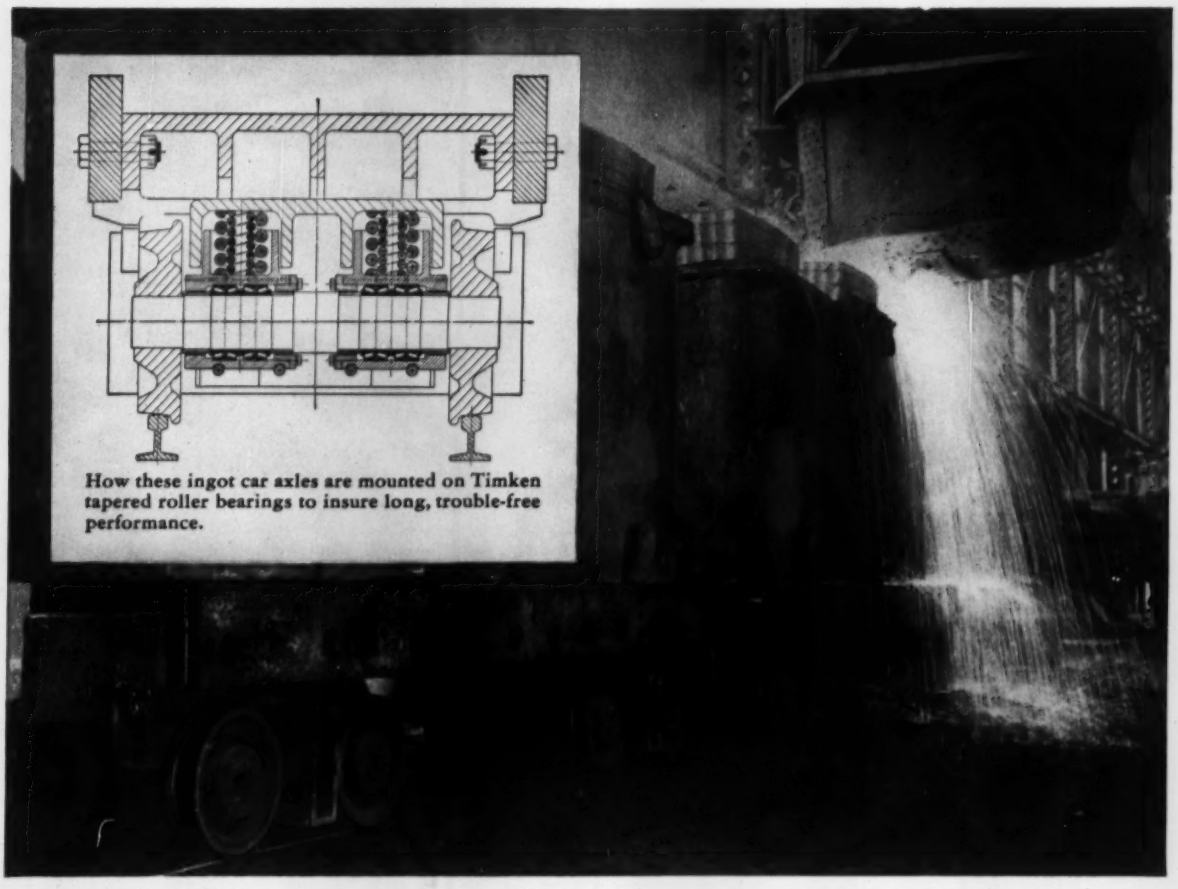
Because case-hardened Timken bearings have tough, shock-resistant cores, they take the shock loads easily, keep the cars ready to roll at any time.

Less hauling power is needed to start the cars, too. Timken bearings' true rolling motion and extremely smooth surface finish practically eliminate friction, cutting starting resistance 88%.

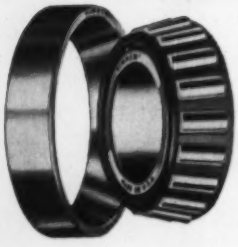
With Timken bearings on the job, the problem of worn-out thrust washers no longer worries mill operators. The tapered construction of Timken bearings takes both radial and thrust loads in *any* combination. No auxiliary thrust devices are needed.

If you build or buy mill equipment, why not get all these advantages? Make sure the trade-mark "Timken" is stamped on every bearing used. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



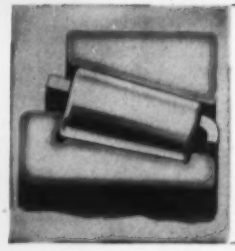
How these ingot car axles are mounted on Timken tapered roller bearings to insure long, trouble-free performance.



TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



GREATER LOAD AREA

Because the load is carried on the *line* of contact between rollers and races, Timken bearings carry greater loads, hold shafts in line, wear longer.

The Timken Roller Bearing Company is the acknowledged leader in: 1. advanced design; 2. precision manufacturing; 3. rigid quality control; 4. special analysis steels.